3P.7465 d

THE
LADIES and GENTLEMENS
DIARY,

OR,

ROYAL ALMANACK;

For the Year of our LORD, 1779:
Being the Third after Biſſextile, or Leap Year.

AND

The Nineteenth Year of the Reign of his Preſent Majeſty
George the Third.

By REUBEN BURROW,
Late Aſſiſtant Aſtronomer at the Royal Obſervatory,
and Teacher of the Mathematics.

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the Stationers Company of the excluſive Privilege of Printing
Almanacks, which they had unjuſtly monopolized 170 Years.

ECLIPSES in 1779.

This year there will be Five Eclipſes, Three of the Sun, and Two of the Moon, which will happen in the following Order: The Firſt Eclipſe is of the Sun, which happens on the 16th of May, at Six Minutes paſt One in the Morning, inviſible. The Second is of the Moon, partly viſible, and happens the 30th of May, beginning Two Minutes paſt Three in the Morning; Middle Fifty-Five Minutes paſt Four, and ending at Forty-Eight Minutes after Six; Digits eclipſed 15° 47′. The Third is of the Sun, viſible, and happens the 14th of June; Beginning Seven Hours Eighteen Minutes in the Morning; Middle at Seven Hours Fifty-Nine Minutes, and ends at Eight Hours Forty-Three Minutes; Digits eclipſed 3°¼ on the North limb. The Fourth is of the Moon, viſible; and happens the 23d of November; Beginning at 6 Hours 7½ Minutes in the Afternoon; Middle 7 Hours 57½ Minutes; and ends at 9 Hours 47½ Minutes; Digits eclipſed 20° 42′. The Fifth is of the Sun, and happens the 7th of December, at 10 Hours 31 Minutes, but inviſible.

COMMON NOTES, 1779.

Golden Number	13	Dominical Letter	C
Cycle of the Sun	24	Roman Indiction	12
Epact	12	Number of Direction	14

Year of Julian Period 6492.

The FOUR QUARTERS of the YEAR.

The Spring Quarter begins this Year the 20th of March, at 5 Hours 53 Minutes after Noon; at which time the Sun enters the *Equinoctial Sign Aries*, making equal Day and Night all the World over.

The Summer Quarter commences the 21ſt Day of June, at 4 Hours 3 Minutes, Afternoon, the Sun then entering into the *Sign Cancer*, making the longeſt Day to all the Northern, and the ſhorteſt to all the Southern Parts of the World.

The Autumnal Quarter begins the 23d Day of September, at 5 Hours 35 Minutes in the Morning, at which Time the Sun enters *Libra*, making again equal Day and Night to all the World.

The Winter Quarter begins the 21ſt day of December, at 9 Hours 57 Minutes, Afternoon, the Sun then entering into the *Tropical Sign Capricorn*, making the ſhorteſt Day to the Northern, and longeſt to the Southern Inhabitants of the World.

WEIGHT and VALUE of the GOLD and SILVER COINS of England.

	WEIGHT.		VALUE.		
GOLD.	dwt.	grs.	l.	s.	d.
A Guinea	5	9,438	1	1	0
Half Guinea	2	16,719	0	10	6
Quarter Guinea	1	8,359	0	5	3
SILVER.					
A Crown	19	8,519	0	5	0
Half Crown	9	16,259	0	2	6
Shilling	3	20,903	0	1	0
Sixpence	1	22,451	0	0	6

Current Gold Coin muſt weigh as follows:

	dwt.	grs.
Guineas	5	8
Half Guineas	2	16
Quarter Guineas	1	8

January hath XXXI Days.

Full Moon	2 day	4 h.	13 m.	afternoon
Laſt Quarter	9 day	0 h.	34 m.	afternoon
New Moon	17 day	5 h.	38 m.	afternoon
Firſt Quarter	25 day	11 h.	27 m.	morning

Sun enters Aquarius
20d. 2h. 32m. morn.
Apparent time.

1	F	Circumciſion	8	5	3	55	23	1S.	6M40	15
2	S	*Aldebaran*, So. 9h. 33m.	8	5	3	55	22	55	☽ riſes	16
3	C	2 S. aft. Chriſt.	8	4	3	56	22	49	4A54	17
4	M		8	3	3	57	22	43	6 18	18
5	Tu	*Jupiter* riſes 10h. 29m.N.	8	2	3	58	22	37	7 41	19
6	W	Epiphany. *Twelfth-Day*	8	1	3	59	22	30	9 2	20
7	Th		8	0	4	0	22	22	10 22	21
8	F	*Lucian*	7	59	4	1	22	14	11 36	22
9	S		7	58	4	2	22	6	Morn.	23
10	C	1 S. aft. Epip.	7	57	4	3	21	57	0 49	24
11	M	*Plow Mond.*	7	56	4	4	21	47	1 58	25
12	Tu	*Old N. Y. day.*	7	55	4	5	21	38	3 9	26
13	W	Camb. T. b. Hilary.	7	54	4	6	21	28	4 18	27
14	Th	Oxford Term begins	7	53	4	7	21	17	5 23	28
15	F	Exchequer opens	7	51	4	9	21	6	6 25	29
16	S	[*Day.*	7	50	4	10	20	55	11 13	30
17	C	2 S. aft. Epip. *Old Twelf.*	7	49	4	11	20	43	☽ ſets	1
18	M	Q. Ch. b. d. kept. Priſca.	7	48	4	12	20	31	4A45	2
19	Tu		7	46	4	14	20	18	5 53	3
20	W	*Fabian.* In 8 d. Hil. 1 Ret.	7	45	4	15	20	5	7 4	4
21	Th	*Agnes*	7	44	4	16	19	52	8 17	5
22	F	*Vincent*	7	42	4	18	19	38	9 29	6
23	S	Hilary Term begins	7	41	4	19	19	24	10 43	7
24	C	3 S. aft. Epip.	7	40	4	20	19	10	11 59	8
25	M	*Converſion of St. Paul.*	7	38	4	22	18	55	Morn.	9
26	Tu		7	36	4	24	18	40	1 20	10
27	W	Pr. A. Fr. b. In 15d. Hil.	7	35	4	25	18	25	2 41	11
28	Th	[2 Ret.	7	33	4	27	18	9	4 4	12
29	F	*Sirius.* S. 9h. 46m.	7	31	4	29	17	53	5 22	13
30	S	K. Char. I. Martyr.	7	30	4	30	17	37	6 31	14
31	C	Septuageſima Sunday	7	28	4	32	17	20	7 24	15

Days	L. of D.	Days inc.	D. breaks	Sun Eaſt	Tw. ends	Cl. bef. S.	7 Stars So.
1	7 51	0 7	5 59	4 41	6 1	4 8	8A45
6	7 58	0 14	5 56	4 43	6 4	6 24	8 23
11	8 8	0 24	5 53	4 46	6 7	8 29	8 1
16	8 19	0 35	5 48	4 49	6 12	10 19	7 40
21	8 32	0 48	5 43	4 53	6 17	11 52	7 19
26	8 47	1 3	5 37	4 57	6 23	13 5	6 58

February hath XXVIII Days.

Full Moon 1 day 3 h. 3 m. morning
Laſt Quarter 8 day 6 h. 37 m. morning
New Moon 16 day 11 h. 36 m. morning
Firſt Quarter 23 day 9 h. 3 m. afternoon

Sun enters Piſces.
18d. 5h. 25m.
Apparent time.

D M	D W	Sundays, Holidays, &c.	Sun riſes		Sun ſets		Sun decl. S.		☽ riſes & ſets		☽'s age
1	M	Mars riſes 11h. 39 night	7	27	4	33	17	3	☽ riſes		16
2	Tu	Purif. V. Mary. Candle. d.	7	25	4	35	16	46	6 A	24	17
3	W	*Blaſe.* Mor. Purif. 3 Ret.	7	23	4	37	16	28	7	49	18
4	Th	*Aldebaran* So. 7. 10	7	21	4	39	16	10	9	9	19
5	F	*Agatha*	7	20	4	40	15	52	10	24	20
6	S		7	18	4	42	15	34	11	36	21
7		C Sexageſima Sunday	7	16	4	44	15	15	Morn.		22
8	M		7	15	4	45	14	56	0	52	23
9	Tu	In 8 days of Pur. 4 Ret.	7	13	4	47	14	37	2	1	24
10	W	*Capella* South 7h. 23m	7	11	4	49	14	17	3	10	25
11	Th		7	9	4	51	13	58	4	11	26
12	F	Hilary Term ends. [15 N	7	7	4	53	13	38	5	8	27
13	S	O. Cand. d. Jupiter ri. 10.	7	5	4	55	13	18	6	0	28
14		C Shrove Sunday *Valentine*	7	3	4	57	12	57	6	39	29
15	M		7	1	4	59	12	37	☽ ſets		1
16	Tu	Shrove Theſday	6	59	5	1	12	16	4 A	52	2
17	W	Aſh Wedneſday. Camb.	6	58	5	2	11	55	6	5	3
18	Th	[Term divides	6	56	5	4	11	34	7	18	4
19	F		6	54	5	6	11	13	8	32	5
20	S		6	52	5	8	10	51	9	49	6
21		C 1 Sunday in Lent	6	50	5	10	10	29	11	6	7
22	M	*Sirius* South 8. 11	6	48	5	12	10	7	Morn.		8
23	Tu		6	46	5	14	9	46	0	26	9
24	W	St. Matth. Ember Week	6	44	5	16	9	24	1	49	10
25	Th		6	42	5	18	9	1	3	8	11
26	F		6	40	5	20	8	39	4	18	12
27	S	*Aldebaran* So. 5h 41m.	6	38	5	22	8	16	5	15	13
28		Hare h. goes o. C 2 S. Lent.	6	36	5	24	7	54	6	1	14

Days	L. of D.		Days inc.		D. breaks		Sun Eaſt.		Tw. end		Cl. bef S		7 Stars So.	
1	9	7	1	23	5	29	5	3	6	31	14	5	6 A	33
6	9	24	1	40	5	22	5	9	6	38	14	32	6	13
11	9	42	1	58	5	14	5	14	6	46	14	40	5	53
16	10	1	2	17	5	5	5	20	6	55	14	29	5	34
21	10	20	2	36	4	57	5	26	7	3	14	0	5	15
26	10	40	2	46	4	47	5	32	7	13	13	15	4	55

March hath XXXI Days.

ull Moon 2 day 2 h. 12 m. afternoon
Laſt Quarter 10 day 2 h. 42 m. morning
ew Moon 18 day 2 h. 52 m. morning
Firſt Quarter 25 day 4 h. 31 m. morning

S. enters Aries.
20d. 5h. 53m.
afternoon.
Apparent time.

1	M	David	6	34	5	26	7	31	6M	33	15
2	Tu	Chad.	6	32	5	28	7	8	☽ riſes		16
3	W	Mars riſes 11h. 50m. N	6	30	5	30	6	45	6 A	42	17
4	Th	*Capella* South 5h. 59m.	6	28	5	32	6	22	8	2	18
5	F		6	26	5	34	5	59	9	18	19
6	S		6	24	5	36	5	36	10	33	20
7	C 3	**Sund. in Lent.** *Perpetua*	6	22	5	38	5	13	11	47	21
8	M		6	20	5	40	4	49	Morn.		22
9	Tu		6	18	5	42	4	26	0	58	23
10	W	Regulus So. 10h. 32m.	6	16	5	44	4	2	2	6	24
11	Th		6	14	5	46	3	39	3	7	25
12	F	*Gregory* M.	6	12	5	48	3	15	3	59	26
13	S	Jupiter riſes 5. 33. Night	6	10	5	50	2	52	4	42	27
14	C 4	**S. in Lent. Mid-Lent S.**	6	8	5	52	2	28	5	17	28
15	M		6	6	5	54	2	4	5	43	29
16	Tu		6	4	5	56	1	41	6	7	30
17	W	*St. Patrick*	6	2	5	58	1	17	6	24	1
18	Th		6	0	6	0	0	53	☽ ſets		2
19	F		5	58	6	2	0	29	7 A	41	3
20	S	*Cutbbert.*	5	56	6	4	0	S 6	9	0	4
21	C 5	**S. in Lent. Paſſ. Sun.**	5	54	6	6	0	N18	10	22	5
22	M	[*Benedict*	5	52	6	8	0	42	11	44	6
23	Tu	Sirius So. 6h. 24m	5	50	6	10	1	5	Morn.		7
24	W		5	48	6	12	1	29	1	5	8
25	Th	**Annun. V. M. Lady-Day**	5	46	6	14	1	52	2	19	9
26	F	Camb. Term ends	5	44	6	16	2	16	3	19	10
27	S	Oxf. Term ends	5	42	6	18	2	39	4	7	11
28	C 6	**S. Lent. Palm Sunday**	5	41	6	19	3	3	4	42	12
29	M		5	39	6	21	3	26	5	7	13
30	Tu	Procyon South 6h. 55m	5	37	6	23	3	49	5	29	14
31	W		5	35	6	25	4	13	5	49	15

Days	L. of D.		Days inc.		D breaks		Sun Eaſt		Tw. ends		l. bef. S.		Stars So.	
1	10	51	3	7	4	41	5	36	7	19	12	40	4 A	44
6	11	11	3	27	4	31	5	42	7	29	11	33	4	26
11	11	30	3	46	4	21	5	48	7	39	11	16	4	8
16	11	50	4	6	4	10	5	54	7	50	8	51	3	49
21	12	10	4	26	3	59	6	1	8	1	7	22	3	31
26	12	30	4	46	3	47	6	7	8	13	5	49	3	13

April hath XXX Days 1779.

Full Moon	1 day	2 h.	1 m.	morning
Laſt Quarter	8 day	10 h.	52 m.	afternoon
New Moon	16 day	3 h.	16 m.	afternoon
Firſt Quarter	23 day	10 h.	40 m.	morning
Full Moon	30 day	2 h.	51 m.	afternoon

Sun enters Taurus.
20d. 6h. 42m. morn.
Apparent time.

1	TH	*Maund. Thurſday*	5 33	6 27	4 36	☽ riſes	16
2	F	Good Friday	5 31	6 29	4 59	8 A 20	17
3	S	*R. Biſhop Chicheſter*	5 29	6 31	5 22	9 35	18
4	C	Eaſter Day. *St. Ambroſe*	5 27	6 33	5 45	10 49	19
5	M	Eaſter Monday *O. Lady-d.*	5 25	6 35	6 8	11 59	20
6	Tu	Eaſter Tueſday	5 23	6 37	6 30	Morn.	21
7	W		5 21	6 39	6 53	1 6	22
8	TH	Regulus So. 8h. 47m	5 19	6 41	7 15	2 2	23
9	F		5 17	6 43	7 38	2 48	24
10	S		5 15	6 45	8 0	3 25	25
11	C	1 S. after Eaſter. Low S.	5 13	6 47	8 22	3 54	26
12	M		5 11	6 49	8 44	4 18	27
13	Tu		5 10	6 50	9 6	4 37	28
14	W	Oxf. and Camb. T. beg.	5 8	6 52	9 27	4 54	29
15	TH		5 6	6 54	9 49	5 10	30
16	F	Procyon So. 5h. 53m	5 4	6 56	10 10	☽ ſets	1
17	S		5 2	6 58	10 31	8 A 12	2
18	C	2 S. after Eaſter. 1 Ret.	5 0	7 0	10 52	9 36	3
19	M	*Alphege.*	4 58	7 2	11 13	11 0	4
20	Tu		4 56	7 4	11 34	Morn.	5
21	W	Term begins	4 55	7 5	11 54	0 20	6
22	TH		4 53	7 7	12 14	1 24	7
23	F	St. George	4 51	7 9	12 34	2 16	8
24	S	Jupiter riſes 8. 49 N.	4 50	7 10	12 54	2 52	9
25	C	3 S. aft. Eaſt. St. Mark	4 48	7 12	13 14	3 21	10
26	M	[Prs. Mary born. 2 Ret	4 46	7 14	13 33	3 44	11
27	Tu		4 44	7 16	13 52	4 2	12
28	W	Spica South 10h. 49m	4 42	7 18	14 11	4 19	13
29	TH		4 41	7 19	14 30	4 35	14
30	F		4 39	7 21	14 49	☽ riſes	15

Days	L. of D.	Days inc.	D. breaks	Sun Eaſt	Tw. ends	Cl. bef. S	7 Stars So.
1	12 53	5 9	3 32	6 15	8 28	3 57	2 A 51
6	13 13	5 29	3 19	6 21	8 41	2 26	2 33
11	13 33	5 49	3 6	6 27	8 54	1 1	2 15
16	13 52	6 8	2 52	6 33	9 8	0 A 16	1 56
21	14 10	6 26	2 37	6 39	9 23	1 24	1 38
26	14 28	6 44	2 21	6 44	9 39	2 22	1 19

May hath XXXI Days.

Laſt Quarter	8 day	5 h. 10 m. afternoon		
New Moon	16 day	1 h. 6 m. morning.	Sun enters Gemini.	
Firſt Quarter	22 day	4 h. 36 m. afternoon	21d. 7h. 19m. morn	
Full Moon	30 day	4 h. 52 m. morning	Apparent time.	

1	S	St. Philip and James	4 37	7 23	15 7	8 A 40	16
2	C	4 S. after Eaſter. 3 Return	4 35	7 25	15 25	9 50	17
3	M	*Inv. of Croſs.*	4 33	7 27	15 43	11 0	18
4	Tu	Regulus So. 7h. 10m	4 32	7 28	16 0	11 58	19
5	W		4 31	7 29	16 17	Morn.	20
6	Th	*John ante P. Lat.* Venus	4 29	7 31	16 34	0 49	21
7	F	[riſes 3. 23. morn.	4 28	7 32	16 51	1 30	22
8	S		4 26	7 34	17 7	2 1	23
9	C	5 S. aft. Eaſter. Rog. S.	4 24	7 36	17 23	2 26	24
10	M	[4 Ret.	4 23	7 37	17 39	2 47	25
11	Tu		4 21	7 39	17 55	3 3	26
12	W	*Old May-day.*	4 20	7 40	18 10	3 20	27
13	Th	Aſcenſ. day. Holy Thurſ.	4 18	7 42	18 25	3 36	28
14	F	On mor. of Aſcenſ. 5 Ret.	4 16	7 44	18 40	3 52	29
15	S	Mars riſes 7. 15. nig.	4 15	7 45	18 54	☽ ſets	1
16	C	Sunday after Aſcenſion	4 13	7 47	19 8	8 A 38	2
17	M	Eaſter Term ends	4 12	7 48	19 22	10 4	3
18	Tu	*Spica* So. 9h. 32m.	4 10	7 50	19 35	11 18	4
19	W	Q. Cha. b. 1744 *Dunſt.*	4 9	7 51	19 48	Morn.	5
20	Th	Oxford Term ends	4 7	7 53	20 1	0 17	6
21	F		4 6	7 54	20 13	0 57	7
22	S	Prs. Elizabeth born	4 4	7 56	20 25	1 29	8
23	C	Whit-Sunday	4 3	7 57	20 36	1 53	9
24	M	Whit-Monday	4 2	7 58	20 48	2 12	10
25	Tu	Whit-Tueſday	4 0	8 0	20 59	2 29	11
26	W	Ember Week. *Auguſtine*	3 59	8 1	21 9	2 43	12
27	Th	*Venerable Bede*	3 58	8 2	21 20	2 59	13
28	F		3 57	8 3	21 29	3 16	14
29	S	K. Ch. II. Reſtored	3 56	8 4	21 39	3 33	15
30	C	Trin. Sun. Camb. T. di.	3 55	8 5	21 48	☽ riſes	16
31	M	Arctu. So. 9h. 32m. 1 Ret	3 54	8 6	21 57	9 A 48	17

Days	L. of D.	Days In.	D.breaks	Sun Eaſt	Tw ends	Cl. aft. S.	7 Stars So.
1	14 46	7 2	2 4	6 50	9 56	3 8	1 A 0
6	15 2	7 18	1 47	6 56	10 13	3 40	0 41
11	15 20	7 36	1 26	7 0	10 34	3 58	0 22
16	15 35	7 51	1 2	7 4	10 58	4 0	0 2
21	15 49	8 5	0 22	7 8	11 38	3 49	11 M 42
26	16 1	8 17	No Night	7 12	All Twil	3 25	11 22

June hath XXX Days.

Laſt Quarter	7 day	8 h.	42 m.	morning
New Moon	14 day	9 h.	0 m.	morning
Firſt Quarter	20 day	11 h.	39 m.	afternoon
Full Moon	28 day	7 h.	46 m.	afternoon

S. enters Cancer.
21d. 4h. 3m. aft.
Apparent time.

1	Th	Nicomede	3 52	8 8	22 5	10 A 43	18
2	W	Oxf and Camb. T. begin	3 51	8 9	22 13	11 29	19
3	Th	*Corpus Chriſti.*	3 50	8 10	22 20	11 59	20
4	F	**K. G. III. bo. 1738** T. beg	3 49	8 11	22 28	Morn.	21
5	S	**Pr. Er. Aug. b.** *Boniface*	3 48	8 12	22 34	0 28	22
6	C	1 S. aft. Trin. In 8 days	3 48	8 12	22 41	0 49	23
7	M	[Holy Trin. 2 Ret	3 47	8 13	22 47	1 7	24
8	Tu	Arcturus South 8h. 59m	3 47	8 13	22 52	1 23	25
9	W		3 46	8 14	22 58	1 37	26
10	Th	**Prs. Amelia born**	3 46	8 14	23 2	1 52	27
11	F	St. Barnabas	3 45	8 15	23 7	2 10	28
12	S		3 45	8 15	23 11	2 31	29
13	C	2 S. aft. Trinity 3 Ret.	3 44	8 16	23 14	☽ ſets	1
14	M	☉ Eclipſed viſible	3 44	8 16	23 17	8 A 51	2
15	Tu		3 44	8 16	23 20	9 59	3
16	W		3 43	8 17	23 23	10 49	4
17	Th	St. Alban	Longeſt day is	16 h. 34 m. long at London.	23 25	11 26	5
18	F	Antares So. 10h. 27m			23 26	11 53	6
19	S				23 27	Morn.	7
20	C	3 S. aft. Tr. *T. K. Edw.*			23 27	0 13	8
21	M	Longeſt day [4 Ret.			23 28	0 30	9
22	Tu				23 28	0 46	10
23	W	Term ends			23 27	1 0	11
24	Th	St. John Bap. Midſum day	3 43	8 17	23 26	1 16	12
25	F		3 44	8 16	23 25	1 34	13
26	S		3 44	8 16	23 23	1 57	14
27	C	4 S. aft. Trinity	3 44	8 16	23 21	2 23	15
28	M	Lyra So. 11h. 59m	3 44	8 16	23 18	☽ riſes	16
29	Tu	St. Peter & Paul.	3 45	8 15	23 15	9 A 22	17
30	W	Buck hunting comes in	3 45	8 15	23 12	9 57	18

Days	L. of D.	Days inc.	D. breaks	Sun Eaſt	Tw. ends	Cl. aft. S.	7 Stars So.
1	16 14	8 30	No real night, but conſtant twilight.	7 15	No real night, but conſtant twilight.	2 40	10 M 58
6	16 23	8 39		7 18		1 52	10 38
11	16 29	8 45		7 20		0 55	10 17
16	16 32	8 48		7 21		obſ. 8	9 57
21	16 34	8 50		7 21		1 13	9 36
26	16 33	dec. 1		7 20		2 16	9 15

July hath XXXI Days.

Laſt Quarter	9 day	9 h.	16 m. aftern.	
New Moon	13 day	3 h.	55 m. aftern.	Sun enters Leo.
Firſt Quarter	20 day	9 h.	8 m. morning	23d. 2h. 53m. mo.
Full Moon	28 day	11 h.	0 m. morning	Apparent time.

1	TH	Antares So. 9h. 34m	3	46	8	14	23	8	10 A 27	19
2	F	*Viſit. B. V. Mary*	3	46	8	14	23	4	10 50	20
3	S	*Dies Comit or.*	3	47	8	13	22	59	11 8	21
4	C	**5 S. aft. Trin.** *Tr. St M*	3	47	8	13	22	54	11 23	22
5	M		3	48	8	12	22	49	11 37	23
6	Tu	Camb. Commencement	3	49	8	11	22	43	11 53	24
7	W	*Tho. Becket.*	3	50	8	10	22	37	Morn.	25
8	TH		3	50	8	10	22	30	0 28	26
9	F	Camb. Term ends	3	51	8	9	22	23	0 48	27
10	S		3	52	8	8	22	16	1 20	28
11	C	**6 S. aft. Trinity.**	3	53	8	7	22	8	2 3	29
12	M	Oxford Act	3	54	8	6	22	0	3 5	30
13	Tu		3	55	8	5	21	51	☽ ſets	1
14	W		3	56	8	4	21	42	9 A 17	2
15	TH	*St Swithin*	3	57	8	3	21	33	9 49	3
16	F	Jupiter ſets 10h. 17m. N	3	58	8	2	21	23	10 12	4
17	S	Oxford Term ends	3	59	8	1	21	13	10 31	5
18	C	**7 S. aft. Trinity**	4	0	8	0	21	3	10 47	6
19	M		4	1	7	59	20	52	11 3	7
20	Tu	*Margaret V. and M.*	4	2	7	58	20	41	11 18	8
21	W		4	3	7	57	20	30	11 36	9
22	TH	*St. Mary Magdalen*	4	5	7	55	20	18	11 58	10
23	F		4	6	7	54	20	6	Morn.	11
24	S	Antares So. 8h. 1m	4	7	7	53	19	53	0 23	12
25	C	**8 S. aft. Trin. St. James**	4	9	7	51	19	41	0 56	13
26	M	St. Ann.	4	10	7	50	19	28	1 40	14
27	Tu		4	12	7	48	19	14	2 32	15
28	W		4	13	7	47	19	0	☽ riſes	16
29	TH		4	15	7	45	18	46	8 A 51	17
30	F		4	16	7	44	18	32	9 11	18
31	S	Aquila So 10h 56m	4	17	7	43	18	17	9 26	19

Days	L. of D	Days de	D. breaks	Sun Eaſt	Tw. ends	Cl. bef. S.	7 Stars So
1	16 29	0 5		7 20		3 16	8 M 54
6	16 23	0 11	No real	7 18	No real	4 11	8 34
11	16 15	0 19	Night.	7 15	Night.	4 57	8 13
16	16 5	0 29		7 13		5 32	7 53
21	15 53	0 41		7 9		5 55	7 33
26	15 40	0 54	0 58	7 5	11 2	6 2	7 13

August hath XXXI Days.

Laſt Quarter 5 day 7 h. 29 m. morning
New Moon 11 day 10 h. 51 m. afternoon
Firſt Quarter 18 day 10 h. 0 m. afternoon
Full Moon 27 day 2 h. 5 m. morning

Sun enters Virgo.
23d. [illegible]h. 13m. mo.
Apparent time.

1	**C**	9 S. aft. Trin. Lam. day	4	18	7	42	18	2	9 A	41	20
2	M	Lyra So. 9h. 38.	4	20	7	40	17	47	9	57	21
3	Tu		4	21	7	39	17	31	10	12	22
4	W		4	23	7	37	17	16	10	28	23
5	Th		4	24	7	36	16	59	10	50	24
6	F	*Transfiguration*	4	26	7	34	16	43	11	16	25
7	S	*Name of Jeſus*	4	27	7	33	16	26	11	52	26
8	**C**	10 S. aft. Trinity	4	29	7	31	16	9	Morn.		27
9	M		4	31	7	29	15	52	0	42	28
10	Tu	St. Lawrence	4	33	7	27	15	35	1	52	29
11	W	Prs. Brunſ. born 1737	4	34	7	26	15	17	☽ ſets		1
12	Th	Pr. of Wales bo. 1762	4	36	7	24	14	59	8 A	15	2
13	F		4	38	7	22	14	41	8	35	3
14	S	Aquila So. 10h. 3m	4	39	7	21	14	22	8	53	4
15	**C**	11 S. aft Trin. *Aſſ. V. M*	4	41	7	19	14	4	9	9	5
16	M	Pr. Fred. born 1763	4	43	7	17	13	45	9	25	6
17	Tu		4	45	7	15	13	26	9	41	7
18	W		4	46	7	14	13	6	10	3	8
19	Th		4	48	7	12	12	47	10	28	9
20	F	[*Athanaſius.*	4	50	7	10	12	27	10	58	10
21	S	Pr. Wm. Hen bo. 1765	4	52	7	8	12	7	11	37	11
22	**C**	12 Sund. aft Trinity	4	54	7	6	11	47	Morn.		12
23	M		4	56	7	4	11	27	0	26	13
24	Tu	St. Bartholomew	4	58	7	2	11	6	1	27	14
25	W	Saturn ſets 9h 38m. N	5	0	7	0	11	46	2	31	15
26	Th	Aquila So. 9h. 19m.	5	1	6	59	10	25	3	41	16
27	F		5	3	6	57	10	4	☽ riſes		17
28	S	*St. Auguſtin*	5	5	6	55	9	43	7	54	18
29	**C**	13 S. aft. Trin. ***St. John***	5	7	6	53	9	21	8	11	19
30	M	[*Bapt. beh.*	5	9	6	51	9	0	8	24	20
31	Tu	Clock with Sun	5	11	6	49	8	38	8	40	21

Days	L. of D.		Days dec.		D. breaks		Sun Eaſt		Tw. ends		Cl. bef. S.		7 Stars So.	
1	15	21	1	13	1	27	7	0	10	33	5	52	6 M	49
6	15	6	1	28	1	47	6	55	10	13	5	28	6	30
11	14	49	1	45	2	5	6	50	9	55	4	49	6	11
16	14	31	2	3	2	22	6	45	9	38	3	56	5	52
21	14	13	2	21	2	37	6	39	9	23	2	50	5	34
26	13	54	2	40	2	52	6	34	9	8	1	32	5	16

September hath XXX Days.

Laſt Quarter 3 day 3 h. 49 m. afternoon
New Moon 10 day 6 h. 56 m. morning
Firſt Quarter 17 day 2 h. 30 m. morning
Full Moon 25 day 4 h. 51 m. afternoon

Sun enters Libra.
23d. 5h. 35m. mo.
Apparent time.

1	W	*Giles*	5	13	6	47	8	17	8A	59	22
2	Th	London burnt 1666 O S	5	15	6	45	7	55	9	22	23
3	F	Aquilæ So. 8h. 50m	5	16	6	44	7	33	9	52	24
4	S		5	18	6	42	7	10	10	39	25
5	**C**	**14 S. aft. Trinity**	5	20	6	40	6	48	11	36	26
6	M		5	22	6	38	6	26	Morn.		27
7	Tu	Eunurchus.	5	24	6	36	6	3	0	53	28
8	W	*Nativity V. Mary*	5	26	6	34	5	41	2	17	29
9	Th		5	28	6	32	5	18	3	48	1
10	F		5	30	6	30	4	55	☽ ſets		2
11	S	Fomalhaut South 11 26	5	32	6	28	4	32	7A	20	3
12	**C**	**15 S. aft. Trinity**	5	34	6	26	4	10	7	36	4
13	M		5	36	6	24	3	47	7	53	5
14	Tu	Holy Croſs	5	38	6	22	3	23	8	12	6
15	W	Ember Week	5	40	6	20	3	0	8	35	7
16	Th		5	42	6	18	2	37	9	5	8
17	F	*Lambert*	5	44	6	16	2	14	9	42	9
18	S		5	46	6	14	1	51	10	26	10
19	**C**	16 S. aft. Trinity	5	48	6	12	1	27	11	22	11
20	M	Saturn ſets 7. 51. night	5	50	6	10	1	4	Morn.		12
21	Tu	St. Matthew	5	52	6	8	0	41	0	28	13
22	W	**K. Geo. III. Cor. 1761.**	5	54	6	6	0	17n	1	37	14
23	Th	Equal Day & Night	5	56	6	4	0	6S	2	49	15
24	F		5	58	6	2	0	30	4	3	16
25	S	Fomalhaut So. 10h. 35m	6	0	6	0	0	53	☽ riſes		17
26	**C**	17 S. aft. Trin. *St. Cypr.*	6	2	5	58	1	17	6A	40	18
27	M		6	4	5	56	1	40	6	54	19
28	Tu		6	6	5	54	2	3	7	13	20
29	W	St. Mich. Prs. Char. A. b.	6	8	5	52	2	27	7	35	21
30	Th	*St. Jerome*	6	10	5	50	2	50	8	4	22

Days	L. of D.	Days dec.	D. breaks	Sun Eaſt	Tw. ends	Cl. aft. S.	7 Stars So.
1	13 32	3 2	3 9	6 27	8 51	0 14	4M54
6	13 12	3 22	3 22	6 21	8 38	1 51	4 36
11	12 53	3 41	3 34	6 15	8 26	3 32	4 18
16	12 33	4 1	3 46	6 9	8 14	5 16	4 0
21	12 14	4 20	3 59	6 2	8 1	7 1	3 42
26	11 54	4 40	4 9	5 56	7 51	8 44	3 24

October hath XXXI Days.

Laſt Quarter 2 day 10 h. 59 m. afternoon
New Moon 9 day 5 h. 13 m. afternoon
Firſt Quarter 17 day 9 h. 52 m. morning
Full Moon 25 day 6 h. 52 m. morning

Sun enters Scorpio.
23d. 1h 26m. aft.
Apparent time.

1	F	*Remigius*	6	11	5	49	3	14S	8 A	42	23
2	S	Mars ſets 8h 57m. N.	6	13	5	47	3	37	9	36	24
3	C	**18 S. aft. Trinity**	6	15	5	45	4	0	10	41	25
4	M		6	17	5	43	4	23	Morn.		26
5	Tu	Fomalhaut South 9 59	6	19	5	41	4	47	0	2	27
6	W	*Faith*	6	21	5	39	5	10	1	33	28
7	Th		6	23	5	37	5	33	2	57	29
8	F		6	25	5	35	5	56	4	22	30
9	S	*St. Denys*	6	27	5	33	6	19	☽ ſets		1
10	C	**19 S. aft. Tr.** *O. Mich. d.*	6	29	5	31	6	42	6	6	2
11	M	Oxf.&Cam. Terms begin	6	31	5	29	7	4	6	23	3
12	Tu		6	33	5	27	7	27	6	44	4
13	W	*Tr. K. Ed. Confeſſor*	6	35	5	25	7	49	7	9	5
14	Th		6	37	5	23	8	12	7	43	6
15	F	Fomalhaut So. 9h 23m	6	39	5	21	8	34	8	27	7
16	S	Jupiter riſes 5. 28. morn	6	41	5	19	8	56	9	18	8
17	C	**20 S. aft. Trin.** *Ethelred*	6	43	5	17	9	19	10	20	9
18	M	**St. Luke**	6	45	5	15	9	40	11	25	10
19	Tu		6	47	5	13	10	2	Morn.		11
20	W		6	49	5	11	10	24	0	38	12
21	Th		6	51	5	9	10	45	1	51	13
22	F	Saturn ſets 6. 20. Night	6	53	5	7	11	7	3	4	14
23	S		6	55	5	5	11	28	4	28	15
24	C	**21 S. aft. Trin.**	6	57	5	3	11	49	5	33	16
25	M	K. Geo. III. Acceſſ. *Criſpin*	6	59	5	1	12	10	☽ riſes		17
26	Tu	K. Geo. III. Procl 1760	7	1	4	59	12	30	5 A	44	18
27	W		7	3	4	57	12	51	6	8	19
28	Th	**St. Simon and Jude**	7	5	4	55	13	11	6	46	20
29	F		7	6	4	54	13	31	7	32	21
30	S		7	8	4	52	13	51	8	38	22
31	C	**22 S. aft. Trinity**	7	10	4	50	14	10	9	54	23

Days	[illegible]		Days de.		D. breaks		Sun Eaſt		Tw. end		Cl. aft. S		7 Stars So.	
1	11	36	4	58	4	20	5	50	7	40	10	22	3 M	6
6	11	15	5	19	4	30	5	43	7	30	11	52	2	48
11	10	55	5	39	4	40	5	37	7	20	13	12	2	29
16	10	36	5	58	4	50	5	31	7	10	14	20	2	11
21	10	17	6	17	4	59	5	25	7	1	15	15	1	53
26	9	58	6	36	5	7	5	19	6	53	15	52	1	33

1779. November hath XXX Days.

Laſt Quarter	1 day	5 h.	47 m.	morning
New Moon	8 day	6 h.	24 m.	morning
Firſt Quarter	16 day	6 h.	35 m.	morning
Full Moon	23 day	7 h.	57 m.	afternoon
Laſt Quarter	30 day	1 h.	16 m.	afternoon

S. ent. Sagittari
22d. 9h. 35m. mo.
Apparent time.

1	M	All Saints	7	11	4	49	14	30S	11 A 17		24
2	Tu	**Pr. Ed. bo 1767** All Souls	7	13	4	47	14	49	morn.		25
3	W	Mor. of all Souls 1 Ret	7	15	4	45	15	8	0	44	26
4	Th	Mars ſets 8. 53 night	7	17	4	43	15	26	2	7	27
5	F	**Powder Plot 1605. O. S.**	7	19	4	41	15	45	3	29	28
6	S	**Mich Ter beg** *Leonard.*	7	20	4	40	16	3	4	48	29
7		**C 23 S aft. Tr. D. Cumb. b.**	7	22	4	38	16	21	6	7	1
8	M	**Prs. Aug Sophia born**	7	23	4	37	16	38	☽ ſets		2
9	Tu	**Ld. Mayor's day**	7	25	4	35	16	56	5 A 10		3
10	W		7	27	4	33	17	13	5	41	4
11	Th	*St. Martin*	7	29	4	31	17	29	6	20	5
12	F	Mor. of St. Mart. 2 Ret	7	30	4	30	17	46	7	8	6
13	S	*Britius.* [Cam. T. di	7	31	4	29	18	2	8	6	7
14		**C 24 S. aft. Trin.**	7	33	4	27	18	18	9	13	8
15	M	*Machutus*	7	35	4	25	18	33	10	19	9
16	Tu		7	36	4	24	18	48	11	30	10
17	W	*Hugh B. Lincoln*	7	37	4	23	19	3	morn.		11
18	Th	In 8 days of St. Mar. 3 Ret.	7	39	4	21	19	18	0	42	12
19	F	Fomalhaut So. 7h. 5m	7	41	4	19	19	32	1	53	13
20	S	*Edm. K. and Mart.*	7	43	4	17	19	45	3	8	14
21		**C 25 S. aft. Trin.**	7	44	4	16	19	59	4	23	15
22	M	*Cecilia.* Old Mart. day	7	45	4	15	20	12	5	44	16
23	Tu	*St. Clement*	7	47	4	13	20	24	☽ riſes		17
24	W		7	48	4	12	20	37	4 A 37		18
25	Th	**D. of Glo. bo. 1743.** Cath	7	50	4	10	20	49	5	23	19
26	F	[in 15d of S. Mart. 4 Ret	7	51	4	9	21	0	6	22	20
27	S		7	52	4	8	21	11	7	37	21
28		**C Advent Sunday**	7	53	4	7	21	22	9	1	22
29	M	**Michaelm. Term ends**	7	54	4	6	21	32	10	25	23
30	Tu	**St. Andrew**	7	55	4	5	21	42	11	47	24

Days.	L. of D.		Days de.		D. breaks		Sun Eaſt.		Tw. end		Cl. aft. S.		7 Stars So.	
1	9	36	6	58	5	17	5	12	6	43	16	14	1 M 10	
6	9	18	7	16	5	25	5	7	6	35	16	8	0	49
11	9	1	7	33	5	32	5	2	6	28	15	42	0	31
16	8	45	7	49	5	38	4	57	6	22	14	55	0	10
21	8	31	8	3	5	44	4	53	6	16	13	48	11 A 45	
26	8	18	8	16	5	49	4	50	6	11	12	21	11	24

November hath XXX Days.

New Moon

Full Moon

All Saints

Pr. Ed. bo. 1767

Powder Treason

Mich. Term begins

23 S. aft. Tr. D. Cumb. b.

Prs. Aug. Sophia born

Ld. Mayor's day

St. Martin

24 S. aft. Trin.

Machutus

St. Hugh B.

25 S. aft. Trin.

St. Edmund

St. Cecilia

Pr. of Gloc. born

St. Catharine

Advent Sunday

Mich. Term ends

St. Andrew

December hath XXXI Days. 1779.

New Moon	7 day	10 h. 31 m. aftern.	
Firſt Quarter	16 day	2 h. 54 m. morn.	S. ent. Capricorn
Full Moon	23 day	7 h. 52 m. morn.	21d. 9h. 57m. aft
Laſt Quarter	29 day	10 h. 37 m. aftern.	Apparent time.

1	W	Fomalhaut So. 6h. 14m.	7 57	4 3	21 52	Morn.	25
2	TH		7 58	4 2	22 1	1 10	26
3	F		7 59	4 1	22 9	2 29	27
4	S	Barbara	8 0	4 0	22 17	3 46	28
5	C	2 S. in Advent	8 1	3 59	22 25	5 3	29
6	M	*Nicholas*	8 2	3 58	22 33	6 19	30
7	TU		8 3	3 57	22 40	7 35	1
8	W	*Conception Virgin Mary*	8 3	3 57	22 46	☽ ſets	2
9	TH		8 4	3 56	22 52	4 A49	3
10	F	Aldebaran So 11h. 12m.	8 5	3 55	22 58	5 46	4
11	S		8 5	3 55	23 3	6 48	5
12	C	3 S. in Advent	8 6	3 54	23 7	7 56	6
13	M	*Lucy*	8 6	3 54	23 11	9 5	7
14	TU		8 7	3 53	23 15	10 15	8
15	W	Ember Week	8 7	3 53	23 18	11 24	9
16	TH	O. Sap. Camb Ter. ends	8 7	3 53	23 21	morn.	10
17	F	Oxford Term ends	8 8	3 52	23 24	0 36	11
18	S		Shorteſt day at	Lond. is 7h. 45m.	23 25	1 47	12
19	C	4 S in Advent			23 27	3 4	13
20	M				23 27	4 24	14
21	TU	St. Thomas. Shorteſt day			23 28	5 46	15
22	W				23 28	7 10	16
23	TH				23 28	☽ riſes	17
24	F	Aldebaran So. 10h. 10m			23 27	5 A 2	18
25	S	Chriſtmas Day	8 8	3 52	23 25	6 26	19
26	C	1 S after Chriſt. St. Step.	8 7	3 53	23 23	7 53	20
27	M	St. John	8 7	3 53	23 21	9 21	21
28	TU	Innocents	8 7	3 53	23 18	10 45	22
29	W		8 6	3 54	23 15	morn.	23
30	TH		8 6	3 54	23 11	0 5	24
31	F	*Silveſter*	8 6	3 54	23 7	1 21	25

Days.	L. of D.	Day dec.	D.breaks	Sun Eaſt.	Tw. ends	Cl. aft. S.	7 Stars So.
1	8 6	8 28	5 53	4 46	6 7	10 35	11 A 2
6	7 57	8 37	5 57	4 43	6 3	8 33	10 41
11	7 50	8 44	5 59	4 41	6 1	6 18	10 19
16	7 46	8 48	6 0	4 40	6 0	3 54	9 56
21	7 45	8 49	6 1	4 39	5 59	1 25	9 34
26	7 46	Incr. 1	6 1	4 40	5 59	1 be 4	9 13

A Table of TERMS and RETURNS.

HILARY Term begins Jan. 23—ends Feb. 12.

Returns or Eſſoign Days.	Exc.	Ret.	Ap	W. D.
In 8 Days of St. Hilary - Jan. 20	21	22	23	Saturd
In Fifteen Days of St. Hilary - 27	28	29	30	Saturd
The Morrow of the Purification Feb. 3	4	5	6	Saturd
In Eight Days of the Purification 9	0	11	12	Friday

EASTER Term begins April 21—ends May 17.

From Eaſter-day in 15 Days, April 18	19	20	21	Wedn
From Eaſter-day in Three Weeks 25	26	27	28	Wedn
From Eaſter-day in 1 Month, May 2	3	4	5	Wedn
From Eaſter-day in Five Weeks 9	10	11	12	Wedn
On the Morrow of the Aſcenſion 14	15	16	17	Mond

TRINITY Term begins June 4—ends June 23.

The Mor of the Holy Trinity, May 3	J. 1	2	3	Friday
In 8 Days of the Holy Trin. June 6	7	8	9	Wedn
In 15 Days of the Holy Trinity 13	14	15	16	Wedn
In 3 Weeks of the Holy Trinity 20	21	22	23	Wedn

MICHAELMAS Term begins Nov 6—ends Nov. 29.

On the Morrow of all Souls, Nov. 3	4	5	6	Saturd
On the Morrow of St. Martin - 12	13	14	15	Mond
In Eight Days of St. Martin - 18	19	20	22	Mond
In Fifteen Days of St. Martin 25	26	27	29	Mond

Note, That the Firſt and Laſt Days of every Term are the Days of Appearance.—No Sittings in Weſtminſter-Hall on the 2d of February, Aſcenſion and Midſummer Days.

Oxford Terms.

Lent Term — begins Jan. 14, ends March 27.
Eaſter Term begins April 14, ends May 20.
Trinity Term begins June 2, ends July 17.
Michaelmas Term begins Oct. 11, ends Dec. 17.
The Act will be July 12.

Cambridge Terms.

Lent Term — begins Jan. 13, ends March 26.
Eaſter Term begins April 14, ends July 9.
Michaelmas Term begins Oct. 11, ends Dec. 16.
The Commencement will be July 6.

HOLIDAYS kept at the EXCHEQUER, BANK, STAMP OFFICE, EXCISE OFFICE, CUSTOM HOUSE, EAST INDIA and SOUTH SEA HOUSES in 1779; viz.

January 1, 6 not at S. Sea Houſe, 18, 25, 30
February 2, 16, 17, 24
March 1 not at Bank, Cuſt. Houſe, Stamp Office, 25
April 2, 5, 6, 7 not C. Houſ. 23
May 1, 13, 24, 25, 26, 29
June 4, 10 not Bank, Cuſt. H. Excheq. 11, 24, 29
July 15 not at Stamp-Office, Bank, Cuſt. or S. Sea H.
Auguſt 11 not Cuſt. H. Bank or S. Sea H. 12, 24.
September 2 not Cuſt. H. 14 not at Bank, Cuſt. H S Sea H. or Stamp O. 21, 22, 29
October 18, 25 not at Cuſt. H. 26 not Cuſt. H. Stamp O. or Exciſe O. 28 not C. H.
Novemb. 1, 2 not at Cuſt. H Bank, Stamp O. or S. S. H. 4, 5, 9 not at Ex. 17 not C. H. Bank, or S Sea H. 25 not at Cuſtom H. Bank, Excheq. or Exciſe O. 30
December 21, 25, 27, 28.

TRANSFER DAYS

At the BANK.

	DIVIDENDS due.
Stock, Tueſday, Thurſday, and Friday	April 5 October 1
3 per cent. reduc. Tueſ. Wed. Th. and Fri.	
4 per cent. conſ. Ann. Mon. Wed. and Fri.	
4 per cent. new, Tueſday and Thurſday	
Short annuities 1777, Wed. and Saturday	
3 1-half per cent. 1758, Mon. Wed. and Fri.	Jan. 5 July 5
3 per cent. conſ. Tu. Wed. Th. and Fri.	
3 per cent. 1726, Tueſday and Thurſday	
Short Annuities 1778, Tueſ. and Thurſ.	
Long Annuities, Wedneſday and Saturday	

At the SOUTH SEA HOUSE.

Stock, Monday, Wedneſday, and Friday	January 5 July 5
3 per cent. New Ann. Tueſ. Thurſ. and Sat.	
3 per cent 1751, Tueſday and Thurſday	
3 per cent. Old Ann. Mon. Wed. and Fri.	Ap. 5. Oct. 10.

EAST INDIA HOUSE.

Stock, Tueſday, Thurſday and Saturday, Jan. 5, July 5.
3 per cent. conſ. Ann. Mon. Wed. and Fr. Apr. 10, Oct. 10.
Dividends paid at the Bank from 9 to 11, and from 1 to 3
Transfers — — from 11 to 1.
Dividends at the South Sea and India Houſes from 9 to 12.
Transfers — — from 12 to 1.
Intereſt on India Bonds due, March 31, September 30.

FINIS.

A COMPANION TO
The LADIES and GENTLEMENS
DIARY,
FOR THE YEAR 1779:

CONTAINING

ÆNIGMAS, REBUSSES,
MATHEMATICAL ESSAYS,
QUESTIONS AND SOLUTIONS, &c.

By REUBEN BURROW,

Late Aſſiſtant Aſtronomer at the Royal Obſervatory; and Mathematical Maſter of the Drawing-Room in the Tower.

LONDON,
Printed for T. CARNAN, in St. Paul's Church-Yard.

ANSWERS *to the* QUERIES, REBUSSES, *&c. in Laſt Year's* DIARY.

Query I. *Anſwered by Mr.* Dalby.

THE *calf* of the leg ſeems to have had its name from two *cimbric* words, *cal*, ſtout (or large, with reſpect to the other parts of the leg) and *lef*, always bent, or of a bended form [*vid. Goropius Becanus*] and from thence the Dutch name *kalf*, from this the Engliſh is evidently borrowed.

Query II. *Anſwered by Miſs* Greville.

When a piece of iron is heated red hot and cooled in the open air its bulk becomes greater, or, it occupies more ſpace, and therefore the particles compoſing it are at a greater diſtance from each other than before, and conſequently the whole is leſs compact and ſofter; but the contrary happens if cooled in water; for, in heating, a great part of the air it contained is excluded by that operation on account of its expanſion and rarefaction; then ſuddenly plunging it in water, the air is thereby prevented from inſinuating itſelf into the metal while it cools, and ſo the particles, having more room, fall nearer together, which evidently muſt render it of a firmer texture.

Query III. *Anſwered by Dr.* Slop.

As Cotton only meant by the words in queſtion to give a burleſque repreſentation of the violence of the ſtorm; his intention was evidently to compare its effects on the world with thoſe of wine on the head of a drunkard; and as the famous Barnaby Harrington was not long before Cotton's time, ſo remarkable for his drunkenneſs and his poetry, he is doubtleſs the perſon alluded to; and therefore to *dance Barnaby*, is only another expreſſion for *reeling*.

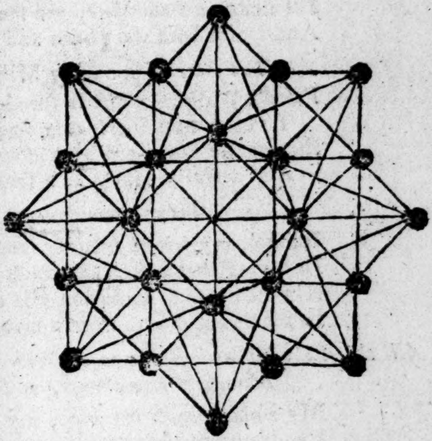
Query IV. *Anſwered by Miſs* Polly Lee.

Problems in plane geometry can be drawn more exact with great diſtances than with ſmall, becauſe all points and lines in *practice* are of ſome breadth, and ſuch breadths will hold a leſs proportion with great than with ſmall diſtances, and conſequently the errors in drawing will be leſs in uſing long lines than ſhort ones: To explain this, ſuppoſe the circumference of a circle whoſe diameter is one-tenth of an inch, is to be divided into 1536 equal parts by lines drawn from the centre, this we will ſuppoſe to be done by a continual biſection of the chords, now when we come to the laſt diviſions, we ſhall find that the lines which are to divide the chords, will be as broad as the chords are long, though perhaps the inſtrument may be as fine as poſſible; but this would not be the caſe if the diameter was two or three yards.

Query V. *Anſwered by* Caput Mortuum.

Whence the ſalt of the ſea proceeds is a curious but difficult problem. According to ſome Naturaliſts it is owing to the mines of *Sal Gem* in the bowels of the earth waſhed down by the rains;-- admitting this, the Sea muſt grow continually ſalter, becauſe the water raiſed by evaporation is freſh. On this ſuppoſition Dr. *Halley* propoſed a theory to determine how long the world has ſubſiſted; but as obſervations have not been made of the degree of its ſaltneſs at diſtant periods of time, it muſt be left to the determination of the curious in future ages.

Anſwer to the Paradox, by Mr. John Wales.



Behold, honeſt *David*, your
leeks I have planted
In twenty-eight rows, and
exact as you wanted;
In the margin pray view
them, nor take them
on truſt,
You may count all the rows,
for the number is juſt.

In this manner it was Anſwered by Mr. Silcock, *and many others.*

Rebus II. *Anſwered by Mr.* John Clarke *of* Lincoln.

Dalby, we know thou canſt with eaſe write well,
But joke no more about that place call'd *Hell.*

Anſwer to the Acrostic Rebus, *by* James Twitcher.

Perfidious France and haughty Spain
Are at their *dirty tricks* again;---
Had but King George adviſ'd with *Chatham*,
The Britiſh Lion had been at 'em.

All the Rebusses *anſwered by Mr.* John Wales.

I find 'tis fam'd *Newton* Miſs Lee ſtrives to hide, I.
And *Hell* is the place where the wicked reſide, II.
Miſs Greville to *nobody* ſeems to be join'd, III.
But Beatrice the fair is in *marriage* combin'd, IV.
Great *Milton* and *Chatham* then bring up the rear; V. VI.
So I hope all the Rebuſſes I've made appear.

Answers *to the* Enigmas *in laſt Year's* Diary.

I. *A maidenhead*
II. *Nothing*
III. *A mouſetrap*
IV. *Tobacco*
V. *Charity*
VI. *Yourſelf*
VII. *A key*
VIII. *A hum* or *deceit*
IX. *Patience*
X. *Nonſenſe*
Prize. *A kiſs.*

The Prize Enigma anſwered by Mr. Joſeph James.

Let poets talk of that or this,
L. Walker well deſcribes a *kiſs*.

The ſame anſwered by Cymon.

As Chloe was ſleeping, Hodge view'd the dear maid
With a rapt'rous eye, and exultingly ſaid;
I'll ſnatch a ſweet *kiſs*, ere ſhe opens her eyes,
And claim both the *gloves* and the Diary Prize!

The ſame anſwered by Milito *of Thingdon.*

Friend Walker, a *kiſs* is ſure higheſt bliſs
To each true and lovely ſweet pair,
But oft the fair maid by kiſſing's betray'd,
And artfully drawn in a ſnare.

The ſame anſwered by Silvia.

Indeed, my friend *Walker*, you're perfectly right
In ſaying that *kiſſing* affords great delight,
A moſt pleaſing ſenſation fills every vein
In receiving *ſalutes* from a favorite ſwain.

All the Rebuſſes and Enigmas anſwered by Miſs Eliz. Cockbill, *of Mansfield Woodhouſe, in Nottinghamſhire.*

My *maidenhead's* my *hope*, my pride, I. IX.
I've beauty's *mouſetrap* on my ſide; III.
The flatterer's *key*-like *kiſs* I'll ſhun, VII. *Prize.*
And from the *ſmoaking* ſot I'll run; IV.
Of prating fops I'll take no heed,
Their *nonſenſe nothing* can exceed; X. II.
Nor ſhall *deceit* my actions ſtain; VIII.
Nor *ſelf* conceit over me reign; VI.
But I'll be jovial, gay and free,
And live with all in *charity*: V.
But, if my lucky ſtars deſign
That I in *marriage* knot ſhall join, IV. *Reb.*
Then may my conſort be as rare
As *Milton* or great *Newton* were. V. I. *Reb.*
With him then I'll to *Chatham* ſail, VI. *Reb.*
And there ſteer thro' life's chequer'd vale,
I'll fear *Nobody's* envious ſpell, III. *Reb.*
Nor all the ſerene wights of *Hell*; II. *Reb.*
But to my love I will prove true
'Till Death commands to bid adieu.

General Anſwer to the Enigmas, by Mr. Leonard Walker.

Accept, my dear Lucy, advice from a friend,
And adhere to the rules which I now recommend:
Tho' Strephon adores you, be careful of this,
To repulſe his bold freedoms nor grant him a *kiſs*, *Prize.*
Such freedoms admitted will lead him to more,
Till he gains the *laſt favor* and makes you a w—e! I.

Let *nothing* perſuade you, not love, praiſe, or pelf, II.
To forget for a moment what's due to *yourſelf*. VI.
Let *meekneſs* and *charity* guide you thro' life, V. IX.
They're the *keys* of true knowledge for maid or for wife; VII.
And will lead you the *nonſenſe* of fops to deſpiſe, X.
And to laugh at the pert and affectedly wiſe;
No *deceit* ever uſe to *entrap* the unwary; VIII. III.
'Twill end but in *fumo* and ſurely miſcarry. IV.
This advice, my dear Lucy, is homely and plain;
Yet I think it can do you no harm in the main.

General Anſwer to all the Enigmas, by Mr. John Clarke *of Lincoln.*

As lately I my annual journey went,
At *Maidenhead* a pleaſant evening ſpent: I.
Nothing was wanting to increaſe our mirth, II.
And drinking deep gave noiſe and *nonſenſe* birth; X.
Snug as are mice within their *wiry-houſes*, III.
We drank remembrance to our abſent ſpouſes;
Smok'd *Trinidado* whilſt we drank our nappy; IV.
Sung glees and catches and were vaſtly happy:
No narrow minded wretch diſgrac'd our board,
Nor ſuch who cannot *charity* afford; V.
But all were ſocial, jovial, merry ſouls,
And briſkly puſh'd about the flowing bowls;
My faculties grew weak, the liquor ſtronger,
I ſoon was tipſy and could ſtay no longer;
Then ſlily left them as my fancy led,
And took *myſelf*, with decency to bed. VI.
I *lock'd* my door that none ſhould therein come, VII.
And laugh'd that I had play'd them ſuch a *bum*. VIII.
With ſweet *content* I ſlept away the night, IX.
And did not wake until the morning light.
The woodlark's ſong proclaim'd th' approaching morn,
And Phœbus rays *ſalute* the waving corn. *Prize*.

Ingenious Anſwers to the Queries, Rebuſſes, Enigmas, &c. have been received from Miſs Lee, Miſs Brown, Silvia, Beatrice, and Meſſ. Rogers, James, Pepys, &c. which for want of room we are obliged to omit. The Prize of ten Diaries fell to the lot of Miſs Eliz. Cockbill; who is deſired to ſend to Mr. Carnan's, N°. 65, St. Paul's Church-Yard, for them.

New QUERIES, REBUSSES, *&c. to be anſwered in next Year's Diary.*

I. QUERY, *by Mr.* Dalby.

How are we to underſtand this expreſſion of Job, Chap. xxvi. ver. 5. Dead things are formed from under the waters, and the inhabitants hereof?

II. QUERY, *by Mr.* John Clarke.

Upon what natural principles are we to account for a ſeemingly otal alteration of *air*, *climate*, and *ſeaſons*, in many different parts of the world ? Why are *ſummers* in *England* become of late years ſo wet and winterly, and in general, the weather ſo uncertain and variable ? And why is *Montpelier* not the ſalutary ſpot it uſed to be ?

III. QUERY, *by Mr.* John Wales.

Diarian artiſts, make appear
How long ſince *hats* firſt came in wear.

IV. QUERY, *by Mr.* Thomas Hoy.

In the ſecond chapter of Samuel, it is mentioned that Eli's ſons uſed a fleſh hook to pull meat out of the pot. *Query*, was this *hook* barbed or not ?

V. QUERY, *by Mr.* J. Burrow.

If a perſon breathes upon the blade of a new knife, razor, &c. the moiſture immediately flies off. What is the reaſon of this ?

VI. QUERY, *by Miſs* Polly Lee.

As candles, &c. burn much faſter in Dr. Prieſtley's, than in common air, might not ſome uſeful method of introducing and confining a ſimilar kind of air in the ſubſtance of gunpowder, be contrived, in order to render it more forcible and inſtantaneous in its exploſion ?

I. REBUS, *by Miſs* Dale.

A quarter of what at the tavern you ſpend,
And what's without either beginning or end,
With three fifths of a broad grin,---connected together,
Is a teazing companion in hot or cold weather.

II. REBUS, *by Mr.* Dalby.

The reverſe of a hue that young Phillis can boaſt,
And three fifths of a knife when the handle is loſt,
If join'd,---to the knowledge of ſomething you're led
That always grows thinner the more it is fed.

III. REBUS, *by* Ayleſbury Jack.

Two thirds of a *fib* and two thirds of *hard-water*,
Are the foes which French ſoldiers purſue with great ſlaughter.

IV. REBUS, *by* Caput Mortuum.

Half a noun with as much of what's commonly hollow,
Is a runner, and one you're obliged to follow.

V. *Paradoxical* REBUS, *by Mr.* G. Pepys.

When to juſt half a thouſand one evil you ſtick,
You've a damnable fellow as fierce as Old Nick.

VI. REBUS, *by Mr.* L. Walker.

A Roman chief, who Sylla's pow'r defy'd ;
A Grecian hero, who by Paris dy'd ;
A famous hunter, who a city built ;
A man, who's charg'd in orient climes, with guilt ;
An era, which the Turkiſh people prize ;
A bird, which views the ſun with ſteady eyes ;

A ſage of Athens, who their laws reviſ'd;
A Roman prince, by all mankind deſpis'd;
A man, whoſe chief companion was his lamp;
What ſhould be always near a ſoldier's camp.
Th' initials join'd, a town will bring to view,
For trade and riches parallel'd by few.

A Paradoxical Problem, by Mr. L. Silcock.

Diarian artiſts, if you pleaſe
To plant me thirty cherry trees,
Thirty-four rows, nor leſs nor more,
And in each row exactly four.

New ENIGMAS *to be anſwered in the next Year's* DIARY.

I. ENIGMA, *by Miſs* Kitty C——.

I from the earlieſt ages date my birth,
Yet am not ſeen in water, air, or earth,
Fond of retreat, I ſeek the ſhady grove,
A foe to friendſhip, but a friend to love;
The powers of muſic have no charms for me,
Yet ſtrange to tell, I'm fond of harmony,
And tho' with wiſdom I am known to dwell,
And calm content admits me to her cell;
Yet bluſhing, ladies, I my weakneſs own,
To virtue I am utterly unknown.

II. ENIGMA, *by Miſs* Dale.

Tell me, ye learned fair ones, what is this
Which all admire, yet very few poſſeſs;
A virtue 'tis, to ancient maids unknown,
And prudes who ſpy all faults, except their own:
Lov'd and defended by the brave and wiſe,
Tho' knaves abuſe it, and like fools deſpiſe.
Secure of me you can no envy move,
For none can envy thoſe whom all muſt love.
In fact, my power adds a brighter grace,
And ſweetens every charm in Sylvia's face.

III. ÆNIGMA, *by the late* Thomas Sadler.

Swift as the wind I cleave the liquid air,
When to my deſtin'd goal I would repair:
Oft doth the flying deer my fury own,
And braveſt warriors hail me with a groan.
Sometimes in ſportive mood by Perſeus' arm
I have been ſent to ſtrike a dire alarm,
Amidſt the feather'd race; who ſoaring high,
By me arreſted quit their native ſky,
Rapid they fall in circling eddies round,
And ſtrike their talons in the ſenſeleſs ground.

Bold Robin Hood in me was greatly ſkill'd,
And often took me with him in the field!
Deſpair and horror mark'd my fearful way,
And ſtouteſt heroes ſhudder'd with diſmay.
Sometimes leſs fear'd, tho' felt with great ſurprize,
I take my ſtation in fair Chloe's eyes:
Then do the beaux my dreaded power try,
And pining lovers in a moment die.
Whene'er ſly Cupid would invade a heart,
He then invokes my never failing art;
Secure in me he ſtrikes the fatal blow,
With love's hot fire the virgins boſoms glow.
Sweet ſleep forſakes their eyes, and from their breaſt,
Are baniſh'd pleaſing thoughts, and balmy reſt.
Tell me, ye fair, my name,---from whence I come,
And may your cheeks preſerve unfading bloom.

IV. Enigma, *by Mr.* John Clarke *of Lincoln.*

Altho' I'm us'd by ev'ry one,
  Of high or low condition,
Yet ſeldom am confin'd alone
  To lawyer or phyſician.
I'm thought miſchievous as a cat,
  On various pretences;
Strange tricks and whimſies I've been at,
  When playing with the wenches.
No town within our king's dominions,
  But to my talents claim a ſhare,
Yet people form abſurd opinions,
  And curſe me oft for being there.
I'm cenſur'd by the keeneſt tongue,
  Severely loaded with abuſe,
And drag a wretched life along,
  Alas! becauſe I'm not of uſe.
Innocent I am by nature,
  Free and light as noontide air;
No harſh lineament or feature
  Ever in my face appear.
The lies of tradeſmen, politicians,
  And lottery-ticket ſellers,
Philoſophers, theologicians,
  Cock-Lane ghoſt, or Punchinellos,
The canting zeal of puritans,
  And Tabernacle preachers,
The honeſt ways of courtezans,
  And vile death-hunting-ſearchers;
All theſe the world will not believe,
  As faith is not their due,
But pin their credit on my ſleeve,
  Becauſe I think them true.

V. Enigma,

V. Enigma, *by Mr.* B. Cleypole, *of Weſt-Ham, Eſſex.*

Ye ſage enigmatiſts, make room,
And let your well known fav'rite come,
Careſs'd by all the Engliſh nation,
And holds diſtinguiſh'd reputation :
But ſtop---perhaps you now will ſwear,
Like boaſting Falſtaff I appear ;
Becauſe when view'd by ſome they tell ye
Like him I'm little elſe but belly ;
Yet I'll confeſs altho' eſteem'd
By others I'm a monſter deem'd.
No Sphinx or Hydra to ſurprize,
Or Argus with his hundred eyes ;
Of ſuch contexture is my frame,
A mouth and body's all I claim ;
And tho' I'm neither fleſh nor blood,
Like human beings crave my food ;
Th' Epicure whoſe conſtant care
Is coſtly dainties to prepare,
Has ſeldom ſuch profuſe ſupply
Of rich and ſumptuous fare as I ;
But fate and knaves at once conſpire
That tortur'd I muſt be with fire ;
And circling flames my entrails burn,
Which unto ſmoke and aſhes turn,
Whilſt I, oh horrible to tell,
Am emblematical of hell ;
But of thoſe torments I make light,
Becauſe they bring an appetite ;
For glutton-like know I receive
All food that my attendants give.
Amazement doubtleſs 'twill create,
When I this well known tale relate ;--
What I diſgorge none will deny
Proud mortals eat, or elſe muſt die ;
Enough is ſaid ; declare my name,
And to the world my worth proclaim.

VI. Enigma, *by Mr.* Clarke, *of Farnham, in Surry.*

Ladies, a female ſlave behold,
That's ſore oppreſt by young and old,
And begs you'll ſhew ſome pity on her,
For friends all turn their backs upon her.
Nor think that I your ſuppliant crave
Your aid unmerited to have,
Or wiſh like ſaints of Aaron's trade
To labour leſs the more I'm paid ;
For tho' I might exemption claim,
Becauſe your fleſh and mine's the ſame ;

Or plead that by my ſhape's confeſt,
I ne'er was meant for work, but reſt;
Yet ſuch like Iriſh pleas ſome dozen,
I leave to Paddy's couſin's couſin,
Who'd rather than not live at eaſe,
Lie down with dogs and riſe with fleas.
Tho' ſmall my limbs, yet in a year
I tons of holy garbage bear;
Tho' ſlender I am often put
To carry loads of learned gut;
Oft laden with this ponderous freight,
I groan beneath the ſinful weight;
Yet not from weakneſs or from fear,
For know that I rude ſhocks can bear,
Not blaſts of rattling winds can move me;
Nor thunders when they roll above me.
The higheſt nobles cringe to me,
The greateſt monarchs bend the knee,
For my aſſiſtance many ſue
In public and in private too;
Ev'n ladies take me oft in hand,
And when I fall they make me ſtand;
Nor can without my aid divine,
The lawyer, judge, or biſhop dine,
For I alone uphold them all,
And but for me the Pope would fall.
In my embrace has Sawney R——
Oft ſeen the lovely *Polly Stow*,
With Ragged Robin at her ſide,
In flower of *** and ****y pride.
Tho' I without the help of man,
More children bear than women can;
Yet think not I'm devoid of charms,
For men oft ſleep within my arms;
Nay more, my miſtreſs oft hath ſeen
Me take my maſter in between.
  Scylla, as ſing poetic rogues,
Was often lin'd with her own dogs,
When danger threaten'd,--coward rout!
In ſuch like caſes mine jump out.
  When right divine was much in vogue,
I was your non-reſiſting rogue;
When high church tories were in power,
I play'd th' obedient paſſive whore;
When drunken ſcoundrels rul'd the ſtate,
I kept bad hours and ſat up late,
Ev'n in theſe virtuous ſober times,
I often join in wicked crimes;
When bloods to bawdy houſes come,
I bounce and fly about the room;

But when they to old Fielding trudge,
I ſtand as ſober as a judge.
In former ages I was furr'd,
I next went bare as any board,
But if you're now diſpos'd to find
My hairy bottom, look behind.

VII. ENIGMA, *by Mr.* Leonard Walker.

Ye wiſe and prudent, lend a patient ear
To one, whoſe friendſhip you ſhou'd all revere;
No needy ſharper claims your ſage regard;
To ſerve you well, ſhall be my ſole reward.
I owe my being to the fruitful earth;
An artiſt form'd and gave that being worth:
All civil ſtates my virtues highly prize;
Tho' nature's ſons my nobleſt deeds deſpiſe.
In this bleſt iſle, where juſtice freely flows,
My perſon's ſacred, by the wiſeſt laws;
The hapleſs wretch, who freedom takes with me,
Oft forfeits fame, and dearer liberty!
Whilſt impious men religion diſbelieve,
At church I ſtill attend both morn and eve;
Nor Pope, nor council, tho' their zeal runs high,
Are truer guardians to the church than I.
I'm ſtill the trav'ller's true and ſteady friend;
And in his journies I on him attend;
In foreign climes, tho' he ſhould long ſojourn,
With zeal I ſerve him, 'till his wiſh'd return.
The hoary miſer oft in me confides,
To guard that wealth, which he with caution hides;
He ſafely may; I ne'er betray my truſt;
Thrice happy Briton, were thy ſons as juſt!
The ſtage I ſometimes tread, with great ſucceſs,
All ranks applaud me, and my worth confeſs;
Tho' Roſcius was the fav'rite of the town,
He never gain'd more fair and juſt renown!
No maſter, yet, cou'd ever truly ſay,
That I demanded either thanks or pay,
Tho' watch and ward I keep, both night and day.
To heap up wealth, the world's great end and aim,
I leave to thoſe, who ſigh for pomp and fame.
Ye lovely fair! may I permiſſion crave,
To prove, that I'm the deareſt friend you have;
Your warmeſt friends muſt yield the palm to me,
For I'm the guardian of your chaſtity!
Tho' England's fair ones may my pow'r diſclaim,
Iberia owns it, and reveres my name.
But I muſt now attend my maſter's call;
Adieu!-- and may ſucceſs attend you all!

VIII. Enigma, *by Miſs* Eliz. Cockbill.

Ye gentlemen in verſe ſublime,
Excuſe a female bard's weak rhyme ;
Nor think like you I couplets chuſe,
Nor in ſuch ſtrains invoke the muſe ;
Nor ſhall I ſing of lawns nor rills ?
Nor flow'ry vales nor lofty hills,
Nor of old Nereus nor his ſtream,
Nor take the Sylvans for my theme.
But ſuch a topic let me chuſe,
As ſportive ſouls can ne'er refuſe.
And, Sirs, if you my theme wou'd trace,
You muſt conſult old Nimrod's race ;
And follow cloſe whate'er betide,
For to Actæon I'm ally'd.
Tho' I'm no man, no bird, nor whale,
I've neither ſhoulders, hair, nor tail.
Two wings I have, tho' never fly,
Nor direct objects can eſpy.
My enemies I ne'er offend,
Tho' many often ſeek my end.
My habitation or retreat,
Is a ſweet pleaſant country ſeat ;
Secret's my cot, and ſeldom found
Either above or under ground :
Where thro' a life of fears I run,
And range alternate with the ſun.
Whore is my name, and long has been,
Tho' with my gallants ſeldom ſeen.
And if by chance mankind I paſs,
They term me of the female race.
Yet often in this maſk of mine
Is wrapt a ſubſtance maſculine !
'Tis ſtrange ! Each ſex in me unite,
Yet ſtill I'm no hermaphrodite !
But, Sirs, if you my ſhape wou'd know,
Pray look for me when at Soho !

Prize Enigma *(of* 10 *Diaries) by Mr.* Dalby.

Ye *beaux*, and *feather'd belles* attend ;---
At my approach obſequious bend,
Nor ſhun me, or you may expect
In tears to mourn the dire neglect !
While I, a handmaid of the graces,
Shall cauſe you many damn'd wry faces.
Is there who've ſeen, in Eaſtern pride,
The *Great Mogul* triumphant ride ?---
Upon the ſelf ſame beaſt that bore him
'Tis two to one I've rid before him ;---
For know, I am, ſuch is your will,
The higheſt office born to fill.---

No miniſter with all his arts
Can boaſt ſuch penetrating parts.
In vain the tyrant ſtrives to hide
From me, who am the ſcourge of pride:
For, ſhould a wight, tho' high in place,
Yet, born of mean ignoble race,
Ambitiouſly uſurp a crown,
I pull the vile pretender down;---
While on the verge of fate he reels,
Mankind perhaps my vengeance feels:
Yet, let me not increaſe your fear,
A meagre form at beſt I wear;
And, tho' you often me will find
Like two with backs together join'd,
A fool who ſhouldn't chance to know me
With half an eye may ſee quite thro' me.
When with majeſtic pace, you oft
In querpo ſee me ride aloft,
Tho' I am not accus'd of fear,
Yet, coward like, I chuſe the rear;
There firmly fix'd, and ſafe from harms,
Am half eclips'd by *Chloe's* charms.---
When croſſes vex I make a ſtand,
Nor do my buſineſs out of hand;
Yet, *Garrick* like,---for I'm but ſmall,
The part I play is capital;
But oft employ'd like ſtateſmens tools
In dirty jobs for knaves and fools,
Then like ſome grov'ling dunce, you ſee
That blockheads are my company;
This, as a reaſon ſome expound
With *monſieur* why I'm always found;
Tho' with him ſeldom I'm at peace,
And like him often *out of caſe.*
Taffy, Got bleſs bur, it is ſaid
With me ne'er troubles much his head,
Yet, from his eyes at *David's* ſhrine
I once a year extract the brine,
Which falling from his ruſſet cheeks
Is ſalt to toaſted cheeſe and leeks:—
Nor let that image turn you ſick,—
I'm the *Arcanum Cephalic*;
No *Pulvis Noſtrum* equals me,
From *dirty Scotch* up to *Rappee.*
After what's ſaid, I need not name
That I a bold intruder am;
Nay, impudent, for 'tis averr'd
I once catch'd *Moſes* by the beard.---
But hold,---for now I make no doubt
E'en *Numſcull's* ſelf can find me out.

Anſwers to the Mathematical Queſtions *propoſed in laſt Year's* DIARY.

I. QUESTION, *anſwered by Mr.* Joſeph Bird, *jun. of* Ipſwich.

BY dividing the ſecond equation by the firſt, $x^2-xy+y^2=\frac{b}{a}$, which taken from the firſt, gives $2xy=a-\frac{b}{a}$, or $xy=\frac{a^2-b}{2a}=d$ by adding this to the firſt equation, and ſubtracting it from the above, we have $x^2+2xy+y^2=a+d$, and $x^2-2xy+y^2=\frac{b}{a}-d$, and extracting the ſquare root, $x+y=\sqrt{a+d}$, and $x-y=\sqrt{\frac{b}{a}-d}$, whence $x=\frac{1}{2}\sqrt{a+d}+\frac{1}{2}\sqrt{\frac{b}{a}-d}$, and $y=\frac{1}{2}\sqrt{a+d}-\frac{1}{2}\sqrt{\frac{b}{a}-d}$.

In the ſame manner it was anſwered by Mr. Hugh Weetman *of* Bennington; *Mr.* W. Watſon *of* Alnwick; *Meſſrs.* James, Merritt, Barker, John Clarke *of* Lincoln, *and* Hatton *the propoſer.*

II. QUESTION, *anſwered by Mr.* Joſeph James *of* Stoke-Biſhop, *near* Briſtol.

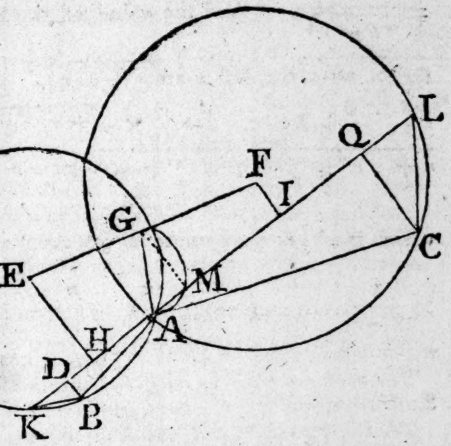
Let x and y be the required numbers; then x^2+y^2-1 and x^2-y^2-1 are ſquares, and their difference is $2y^2$, which being reſolved into the factors $2y$ and y, and half the difference ſquared and made equal to x^2-y^2-1, gives $x^2=\frac{5}{4}y^2+1$, which aſſume equal to the ſquare of $1+vy$ and y will be found equal $\frac{8v}{5-4v^2}$ and conſequently x equal $\frac{5+4v^2}{5-4v^2}$, in which if v be taken 1, $y=8$ and $x=9$.

Nearly in the ſame manner this queſtion was anſwered by Meſſrs. Ainſworth, Barker, Clarke, Fininley, Hedley, Moody, Merrit, Smith, Swift, Watſon, Weetman, *and the propoſer.*

III. QUESTION, *anſwered by Mr.* Ainſworth.

Upon AB, AC including the given ∠ BAC, reſpectively deſcribe ſegments of circles, containing ½ right ∠'s. And biſect EF, the line joining their centers in G, draw GA, and upon it deſcribe the ſemicircle G M A, in which inſcribe the chord A M, equal to ¼ the difference between A B and A C. Then upon A M produced, let fall the ⊥'s B D, C Q, and the thing will be done.

Demon.



Demonſt. For produce A D, A Q to meet the circles in K, L. and draw B K, C L. Alſo let fall the ⊥'s E H, F I. Then becauſe E G = G F, H M = M I. conſequently A I − A H = 2 A M = $\frac{1}{2}$ the given difference. And A L − A K = 2 A I − 2 A H = the given difference = A C − A B, or A L − A C = A K − A B. But becauſe the ∠'s C L Q and B K D are by conſtruction $\frac{1}{2}$ right ∠'s, Q L = Q C and D K = K B. Therefore A L = A Q + Q C, and A K = A D + D B, and conſequently A Q + Q C − A C = A D + D B − A B, or which is the ſame thing, the diameters of the circles inſcribed in the △'s A Q C and B D A are equal.—Q. E. D.

Algebraical ſolutions were alſo received from Mr. Hardy, *the propoſer, and ſeveral others.*

IV. Question, *anſwered by Mr.* William Watſon *of* Alnwick.

From the given equation is had $\dot{y} = \frac{a\dot{x} + x\dot{x}}{\sqrt{a^2 - x^2}}$, or by taking the fluents $y =$ arch whoſe ſine is x to rad. $a. - \sqrt{a^2 - x^2}$. Alſo $x\dot{y} = \frac{ax\dot{x} + x^2\dot{x}}{\sqrt{a^2 - x^2}}$, whoſe fluent is $\frac{1}{2}a \times$ arch, whoſe ſine is x to rad. $a - \overline{a + \frac{1}{2}x} \times \sqrt{a^2 - x^2}$. Or by ſuppoſing that $x = o$, when $y = o$, the correct fluents of $\dot{y}$ and $x\dot{y}$ will be $a - \sqrt{a^2 - x^2} +$ arch, whoſe ſine is x to rad. a. And $a^2 + \frac{1}{2}a \times$ arch, whoſe ſine is x to rad. $a - \overline{a + \frac{1}{2}x} \times \sqrt{a^2 - x^2}$, which laſt taken from $xy = ax - x\sqrt{a^2 - x^2} + x \times$ arch, whoſe ſine is x to rad. a — will give the fluent of $y\dot{x}$.

In the ſame manner it was alſo anſwered by Mr. Ainſworth; *and the anſwers given by Meſſrs.* Bonnycaſtle, Barker, Caput Mortuum, Hampſhire, James, Merritt, Pepys, Weetman, *and the propoſer, were nearly ſimilar.*

V. Question, *anſwered by Mr.* Ainſworth, *and the propoſer.*

Put $\frac{1}{1.05} = r$. and for convenience ſuppoſe $a = 1$. Then the preſent value of the whole eſtate will be $r + 2r^2 + 3r^3 + 4r^4 +$ &c. =

$= \frac{r}{\overline{1-r}|^{2}}$. And the value of the reverſion, or the terms of this ſeries, after the firſt x are $\overline{x+1}.r^{x+1} + \overline{x+2}.r^{x+2} + \overline{x+3}.r^{x+3} + \&c. = xr^{x} \times \overline{r+r^{2}+r^{3}+r^{4}+\&c.} + r^{x} \times \overline{r+2r^{2}+3r^{3}+4r^{4}+\&c.} = xr^{x} \times \frac{r}{1-r} + r^{x} \times \frac{r}{\overline{1-r}|^{2}}$, which muſt per queſtion be $= \frac{1}{2} \times \frac{r}{\overline{1-r}|^{2}}$, that is $xr^{x} + r^{x} \times \frac{1}{1-r} = \frac{1}{2} \times \frac{1}{1-r}$. In numbers $xr^{x} + 21r^{x} = 10\frac{1}{2}$, or $r^{x} \times \overline{x+21} = 10\frac{1}{2}$, from which x may eaſily be found $= 33,9$, or nearly 34 years, the time required.

The anſwers given by Meſſrs. Bonnycaſtle, Dalby, Hampſhire, James, Sanderſon, *and* Pepys, *were nearly the ſame as above.*

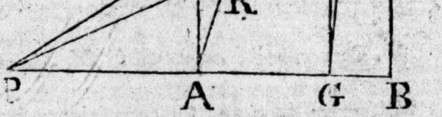
N. B. The ſixth and ſeventh queſtions were inſerted by miſtake, the one having already been anſwered in Mr. *Lawſon*'s Tangencies, and the ſolution of the other taking up more room than is conſiſtent with the limits of the preſent diary.

VIII. QUESTION, *anſwered by Mr.* Ainſworth.

Let s be the required ſum, and $2n+3=m$, or $m=2$, then by the nature of the ſeries $\overline{m-2} \times \overline{m-1}|^{2} \times m^{3} = s$, or $m^{4} - 4m^{3} + 4m^{2} - 2m = s$. The correct integral of which is found by page 46, Emerſon's Increments, to be $s = \frac{m^{7}}{14} - \frac{5}{6}m^{6} + \frac{7}{2}m^{5} - 6\frac{1}{12}m^{4} + 3m^{3} + \frac{5}{3}m^{2} - \frac{4}{7}m - \frac{3}{4}$.

This queſtion was alſo anſwered by Mr. Ur. Bowerburne, *from* Sterling's *Differential Method, and by Mr.* George Sanderſon, *and Mr.* John Bonnycaſtle *according to the method of Increments.*

IX. QUESTION, *anſwered by Mr.* John Hampſhire.



Let B A be produced to P ſo that B P may be to P A in the given ratio of B L to A R and B M to A S and draw A C and G H parallel to B M, and join P L, P M meeting A C and G K in the points C, D, H, K and join the points C, R and D S, H T and K V.

Then by conſtruction, B P : P A : : B L : A R but B P : P A : : B L : A C therefore A C = A R and by the ſame reaſon A D = A S and D S parallel to C R; again, becauſe A D and G K are parallel, B G : G A : : L H : H C : : M K : K D, but B G : G A : : L T : T R : : M V : V S

V S by hypotheſis; wherefore C R, D S, H T and K V are parallel; now $HT : CR :: BG : BA$ and $CR : DS :: AC : AD$, and $DS : KV :: (MD : MK) :: BA : BG$, therefore $HT : KV :: AC : AD$ but $AC : AD :: GH : GK$ therefore $GH : GK :: HT : KV$ and conſequently the points G, T, V which divide the line. B A, L R, M S in the given ratio of B G to G A are in a right lines

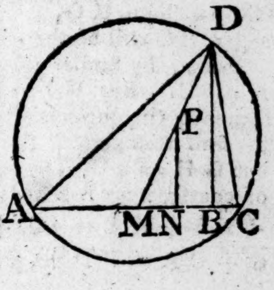
Scholium. This queſtion is in effect the ſame as Newton's 23 *lemma, which was not obſerved by the propoſer at the time of ſending it; however it will doubtleſs be agreeable to the readers to have different ſolutions to ſo uſeful a problem.*

In the ſame manner it was anſwered by Mr. Ur. Bowerburne; *very elegant geometrical demonſtrations were alſo received from Meſſrs.* Ainſworth, Sanderſon, *and* Moſs *the propoſer.*

X. Question, *anſwered by Mr.* William Fininley.

Conſtruc. Biſect the baſe A C in M, on A C deſcribe a ſegment containing the given vertical angle, and take any line M N and N P perpendicular to it, ſo that M N may be to N P as the radius of the circle to the given baſe; join M P meeting the circumference in D, then A D C is the triangle required.

For draw D B parallel to N P then $MB : BD :: R$ (radius) $: AC$ therefore $DB \times R = AC \times MB$ conſequently $DB \times$ diameter $= AC \times 2MB = AD^2 - DC^2$; but $DB \times 2R = AD \times DC$ by 6. Eucl. therefore $AD \times DC = AD^2 - DC^2$.



Geometrical conſtructions were received from Meſſrs. Ainſworth, Barker, Moody, *and* John Clarke *of* Lincoln; *and very elegant algebraical ſolutions from Meſſrs.* Watſon, James, Weetman, Merritt, Pepys *and* Caput Mortuum.

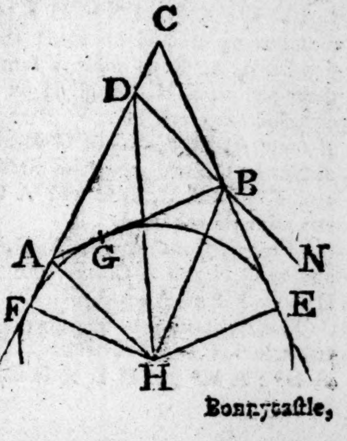
XI. Question, *anſwered by Mr.* George Sanderſon.

Analyſis. Let C D be the given difference, then becauſe A D and A B are equal, $ADB = ABD$, and F A H being half F A B is equal to A D B, therefore A H and D B are parallel, conſequently $AHB = HBN$ but A H B is half the ſupplement of A C B (by Prop. 3, Diary 1777) therefore H B N is half the ſupplement of C: Hence this

Conſtruc. On H D deſcribe a circular ſegment containing an angle equal to half the angle C together with a right angle, cutting C E in B, then A C B is the triangle required.

Limitation. When the circular ſegment deſcribed on D H neither cuts nor touches C B the queſtion is impoſſible; it is alſo evident that whether the point D be in A C or A C produced the method will ſtill be the ſame.

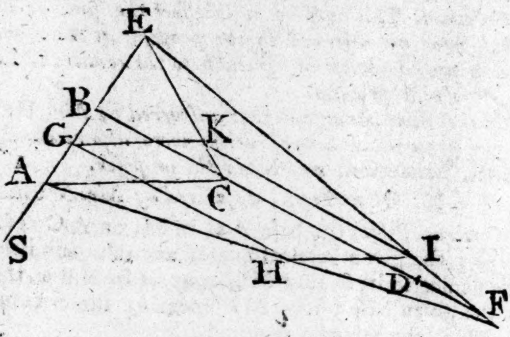
In the ſame manner it was anſwered by Mr. John Burrow; *alſo very elegant geometrical ſolutions were received from Meſſrs.* Ainſworth,



Bonnycaſtle, Barker, Dalby, *and* Dixon; *and algebraic anſwers from Meſſrs.* James *and* Watſon.

The ſame anſwered by the Rev. Mr. Crakelt, *of* Northfleet, *in* Kent.

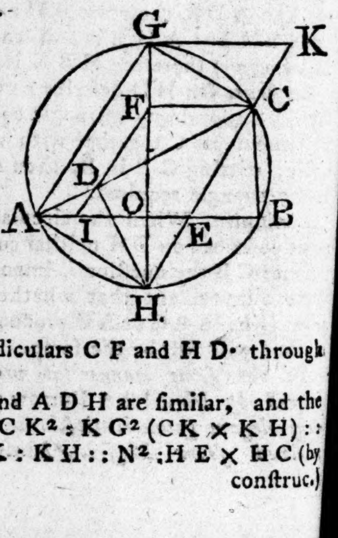
Conſtruc. Make $BD =$ the given perimeter, the $\angle DBS =$ the given vertical one, and BE and DF each equal the given difference betwixt the baſe and the ſide, and join points E and F: take EG at pleaſure, and parallel to BD draw GH equal to 2GE; alſo to EF apply $HI = GE$, and complete the parallelogram GHIK: then thro' the points E, K, draw the line EKC, and afterwards CA parallel to KG, and ABC will be the triangle required.



Demon. By ſimilar triangles $EG : GK = HI$ (Euc. 1. 34.) $:: EA : AC$. But $HI = EG$, by *conſtr.* $\therefore EA = AC$, and conſequently the difference betwixt AC and AB is EB.------Moreover, by ſim. triangles, $EA : EG :: EC : EK :: CF : KI$ or GH; but $GH = 2GE$, by *conſtr.* $\therefore CF = 2EA = EA + AC$; and of courſe, ſince BE and DF are equal, [$CF + FD$ or $CD = AE + EB + AC$ or $AB + AC$, and adding $\overline{BC}$ to each] $AB + \overline{BC} + CA = BD$ the given perimeter. Q. E. D.

XII. Question, *anſwered by Mr.* George Sanderſon.

Conſtruc. Let M be half the given baſe, and N half the difference of the ſides, make CE equal to given biſecting line on which produced, take CK to EK in the duplicate ratio of N to M; again by prop. 5. cor. 3. D. 1777. produce KE to H, ſo that $CK : KH :: N^2 : HE \times HC$ and having erected on KH the perpendicular CG to meet a ſemicircle deſcribed on KH, join GH on which deſcribe the circle HAGB and thro' E draw A, E, B, to cut GH at right angles in O, and meet the circle in A and B join AC, BC and ACB is the triangle required.



Demonſt. Join AH, AG, GK and to GH and AC draw the perpendiculars CF and HD· through D draw FI meeting AB in I.

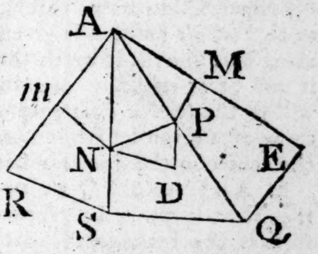
The right angled triangles GCH and ADH are ſimilar, and the triangle KCG is ſimilar to HCG $\therefore CK^2 : KG^2 (CK \times KH) :: AD^2 : AH^2 (= HE \times HC) :: CK : KH :: N^2 : HE \times HC$ (by conſtruc.)

conſtruc.) wherefore $AD = N$ equal (by prop. 9. page 40. Diary, 1777.) to half the difference of A C and B C. moreover as the right angles C F H and C D H are ſubtended by the ſame baſe C H, a circle will paſs through the four points C, F, D, H, whence the angle $DFH = DCH = AGH$, (Euc. 21. 3.) wherefore F I is parallel to A G. and by ſim. triangles $AD^2 : GC^2 :: AH^2 : GH^2 :: AO^2 : AG^2$ whence alternately $AD^2 : AO^2 :: GC^2 \ (= GF \times GH) : AG^2 \ (= GO \times GH) :: GF : GO :: CK :: KE :: N^2 : M^2$ (by conſtruc.) again by alternation $AD^2 : N^2 :: AO^2 : M^2$ but $AD = N$ therefore $AO = M$ but A O equal to half A B (Euc. 3. 3.) therefore M equal to half A B. Q. E. D.

Algebraical ſolutions were alſo received from Meſſrs. Barker, Bowerburne, Fininley, James, Hampſhire, Merritt, Pepys, Watſon and Weetman, &c. *and geometrical ones from Meſſrs.* J. Burrow, *and* I. Dalby.

XIII. Question, *anſwered by Mr.* Iſaac Dalby, *the propoſer.*

This queſtion requires that when the three planes are formed into a ſolid angle, the two firſt planes may make a given angle; which is a caſe that ſometimes happens among carpenters and ſtone-cutters, &c. and its reverſe being equally neceſſary, I ſhall here give ſolutions to both; as they may ſometime happen to be uſeful to the practical workman.



Firſt, Let R A S, S A Q, Q A E be three given plane angles ſuppoſed to be ſpread out on a plane; it is required to find the angle that would be made by the planes R A S, E A Q ſuppoſing them revolved about S A and A Q till R A coincide with A E.

Take Am equal A M, of any given length, and draw M P and mN perpendicular to A E and A R meeting A Q and A S in P and N, and on P N deſcribe a triangle ſo that $PD = PM$, and $ND = Nm$, then N D P is the angle required.

The demonſt. will be evident by conceiving the triangle N D P revolved about N P when A R and A E coincide, for then the points m, D and M coincide alſo.

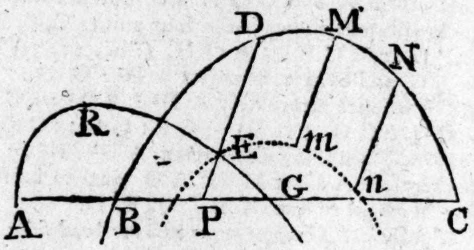
Secondly, Let the angular planes R A S, Q A E be given to find S A Q ſo that when R A coincides with A E the angle made by thoſe planes may be given.

Take $Am = AM$ and draw mN and M P as before, then make an angle N D P equal the given one and take $DN = Nm$ and $DP = PM$, then on N P make a triangle whoſe ſides are the given lines N A, A P which determines the required triangle.

Solutions were alſo given by Meſſrs. Ainſworth, Bonnycaſtle, Hampſhire, Sanderſon *and* Pepys.

XIV. Question, *anſwered by the Propoſer.*

In the given curve B D C let there be taken as many points D, M, N, &c. as are ſufficient to determine a curve of the ſame kind (for example, 3 for a circle, 5 for a conic ſection, &c.) and parallel to the line given in poſition draw M *m*, N *n*, &c. equal to the given line ; then through the points *m*, *n*, &c. draw a curve of the ſame kind as the given one, meeting A R G the other given curve in E ; then D E P will be the line required : For if from a point, lines be drawn, and lines be taken in each having a conſtant ratio, then if the extremes of one fall in a curve of any kind, the extremes of the others will fall in curves of the ſame kind ; and when the point is at an infinite diſtance, as in the preſent caſe all the lines D E, M *n*, will be equal, and B E *m n* equal to B D M N.



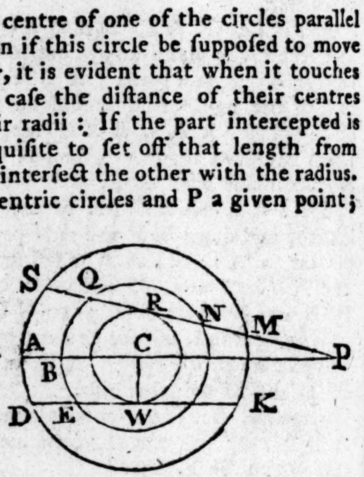
This Problem will be found of great uſe in reſolving and determining the limits of many geometrical queſtions ; I ſhall only ſubjoin two of the eaſieſt examples.

1. Let there be given, two circles in magnitude and poſition and alſo the direction of a line, it is required to intercept between the peripheries of the two circles, a line parallel to this line which may be the leaſt or greateſt poſſible.

Suppoſe a line drawn through the centre of one of the circles parallel to that whoſe poſition is given ; then if this circle be ſuppoſed to move along this line till it touch the other, it is evident that when it touches it will be at its limit, and in that caſe the diſtance of their centres will be the ſum or difference of their radii : If the part intercepted is to be of a given length it is only requiſite to ſet off that length from the centre in the line aforeſaid, and interſect the other with the radius.

2. A S F and B S Q are two concentric circles and P a given point ; required to draw a line through P, ſo that the intercepted part Q S may be of a given length.

Join P C and draw D E W parallel to P C ſo that D E may be the given length, let C W be perpendicular to D W and with the diſtance C W deſcribe a circle and draw a line from P to touch it, meeting the other circles in Q and S then S Q is the given line. For D K = S M therefore D W = S R but E W = Q R conſequently D E = S Q ; and the limits are determined by the laſt.



The conſtruction is the ſame whether the point be within or without the circle, and ſerves for all that Dr. *Horſley* has ſplit into a dozen caſes, and filled eight pages of his Book of Inclinations with ; and here it may not be amiſs to obſerve that the limits of the problems contained in that book, may be determined in a much ſimpler manner than that uſed by the Doctor, from this principle ; that if the rectangle of two quantities be given, their ſum will be leaſt when their difference is leaſt, and their ſum greateſt when their difference is greateſt.

This queſtion was alſo anſwered by Meſſrs. Ainſworth, Bonnycaſtle, Dalby, *and ſeveral others.*

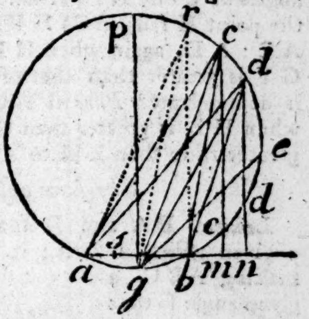
XV. QUESTION, *anſwered by Mr.* J. H.

As the ſection of the ſolid in any part whatever, parallel to the horizon remains the ſame, it is evident the content of the ſolid will be the ſame as that of a priſm of the ſame height; and as the velocity of any point aſſumed in the triangle may be conceived to be divided into an equable horizontal motion, and a vertical one uniformly accellerated, the lengths of the ſpiral curves deſcribed by the angular points will be the ſame as thoſe of parabolic arches. *The manner of determining the ſurfaces of figures generated in a ſimilar manner will be ſhewn in a future number.*

In the ſame manner it was anſwered by Mr. Ainſworth, *and ſome others.*

PRIZE QUESTION, *anſwered by Mr.* Jeremiah Ainſworth.

Upon any line ab taken at pleaſure deſcribe a ſegment of a circle to contain an angle equal to the common difference of the arches; which biſect by the diameter gp, and make the angles pgd, pgc equal to the reſpective diſtances of the middles of the equal arches from the *beginning* of the quadrant: Then if e be the middle of the ſemicirc. gep, the angles dge and cge will evidently be their diſtances from the *middle.* On ab produced * let fall the perpendiculars dn, cm and join da, db, ca, cb; then ſince by Eu. 29. 1, the $\angle gdn = dgp$ and $gcm = cgp$, alſo $gdb = gcb$ = by conſtruction, $\frac{1}{2}$ the common difference of the arches. It therefore follows that the 4 arches themſelves will be the meaſures of the $\angle$'s ndb, nda; mcb and mca reſpectively; conſequently the ratio of their reſpective tangents will be that of bn to an, and bm to am. Of the two arches ec, ed let ec be the greater, and conſequently bn greater than bm. take $bn : ba :: bm : bs$. then ſince bn is greater than bm, ba is greater than bs, and conſequently am than sm. but by compoſition $bn : an :: bm : sm$. and becauſe sm is leſs than am, bm has to sm a greater ratio than it has to am; conſequently bn has to an a greater ratio than bm has to am. Q. E. D.

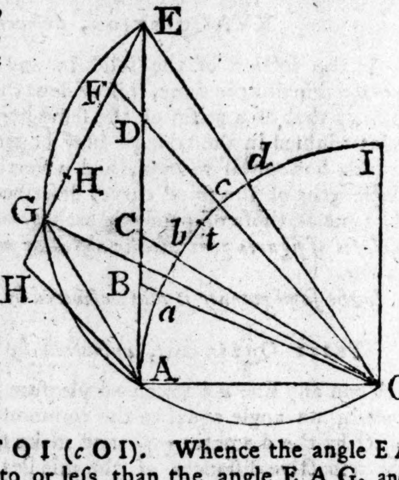


And when $ed = ec$. the propoſition is evident — therefore *all* the caſes are demonſtrated — * that the $\perp cm$ muſt fall upon ab produced appears from hence; that if the diameter ar be drawn and rb joined, it will be $\perp$ to ab (by Eu. 31. 3.) therefore by the nature of the queſt. and conſtruction the $\angle pgc$ can never be equal to or leſs than half the common difference of the arches $= grb = pgr$.

The ſame anſwered by Mr. George Sanderſon.

Let A I be the given quadrant, t the middle point, O the center, and Aa, Ab, Ac, Ad, the four arches taken ſuch that ab, the diff. of the two firſt may equal to cd the diff. of the two laſt; alſo let A B, A C, A D, and A E be tangents to the ſaid arches; and having joined O B, O C,

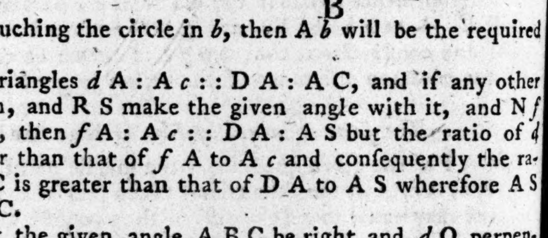
O D,



O D, O F, on O E as a diameter, deſcribe the ſemicircle O A E, to which draw O G making the angle E O G = A O C. join E, G, cutting O D produced in F, and A H drawn || to O D in H. Then becauſe A E is || to O I and A H to O D the angle E A H = F O I (= C O I) and the angle E A G = E O G (Eu. 21. 3.) = (by conſt.) A O C or A O *b*. But as the arch *a b*, = *c d*, and A *t*, = *t* I, when *b t*, is greater than *t c*, the angle A O *b*, (A O C) is manifeſtly leſs than F O I (*c* O I) and when equal, equal; and when leſs, the angle A O *b* (A O C) is greater than F O I (*c* O I). Whence the angle E A H is accordingly greater equal to or leſs than the angle E A G, and the line E H, accordingly greater equal to or leſs E G, but the triangles G O E and G O F are reſpectively equiangular to the triangles A O C and A O B ∵ A C : A B : : G E : G F and by ſimilar triangles A E : A D : : H E : H F; but when H E is equal to G E (or the point H falls in G) H F = G F, then G E : G F : : A C : A B : : A E : A D, again when H E is greater than G E the ratio of G E to G F is greater than that of H E, to H F, and when leſs, leſs, (as is demonſtrated *Barrow*'s Geom. Lectures, page 121). Therefore when H E is greater than G E (*b t* greater than *c t*) C A to AB is a greater ratio than E A to A D, and when leſs, leſs. Q. E. D.

The ſame anſwered by Reuben Burrow.

Lemma. D A and D B are two lines given in poſition, and A a given point in D A; it is required to draw two lines A B, B C making A B C a given angle ſo that A C may be the leaſt poſſible. Take any line A *c* and deſcribe a ſegment thereon containing the given angle, and draw *d b* parallel to D B touching the circle in *b*, then A *b* will be the required poſition of A B.

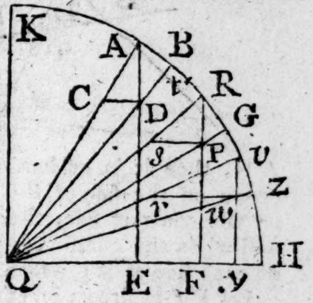


For by ſimilar triangles *d* A : A *c* : : D A : A C, and if any other line A R be drawn, and R S make the given angle with it, and N *f* be parallel to B D, then *f* A : A *c* : : D A : A S but the ratio of *d* A to A *c* is greater than that of *f* A to A *c* and conſequently the ratio of D A to A C is greater than that of D A to A S wherefore A S is greater than A C.

Corollary 1. Let the given angle A B C be right and *d* Q perpendicular to A *b*, then if it was required to find two arcs differing by a given quantity ſo that the tangent of the greater ſhould have to the tangent of the leſſer the leaſt ratio poſſible, the greater arc would exceed 45° by half the given difference, and the leſſer would be leſs than 45° by half the difference : for if At be half the ſemicircle, Acb is $= 45^\circ + bct = 45^\circ + \frac{1}{2} Adb$ and $bdQ = AdQ - Adb = Acb - Adb = 45^\circ - \frac{1}{2} Adb = DAB$.

Corollary 2. Hence alſo the more the angle D A B varies from $45^\circ - \frac{1}{2}$ *the diff.* the ratio of D A to D C becomes the greater.

To apply this to the queſtion. Let K H be a quadrant, biſected in t, and let A H and B H, R H and G H be four arcs whoſe differences A B and R G are equal; then if A B and R G are ſo poſited that $tB = tR$ then (becauſe radius is a mean proportional between the tangent and cotangent) $t.RH : r :: r : t.HB$ and $t.GH : r :: r : t.AH$ wherefore $t.RH : t.GH :: t.AH : t.HB$ that is $RF : FP :: AE : ED$ but $RF : FP :: RQ : QS$ and $AE : ED :: AQ : QC$, therefore A C and R S are equal; but if any arc vz equal to R G be taken at a greater diſtance from t than R G, and vwy be drawn ⊥ to Q H meeting Qz in w, and wr be parallel to Q N meeting Qv in r, then vr will be greater than R S by the lemma, and conſequently the ratio of vQ to Qr or vy to yw, is greater than that of R F to F P, and on the contrary when vz is taken nearer to t, the ratio will be leſs.



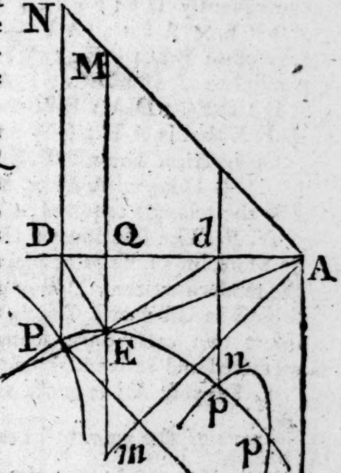
The Prize of Twelve Diaries was the lot of Mr. Ainſworth, *and that of Six, of Mr.* George Sanderſon.

Anſwer to the PRIZE-QUESTION, *omitted laſt Year.*

Lemma. Given the baſe, an angle at the baſe and the rectangle made by the ſide adjoining to it, and the ſum or difference of the other two; to find the triangle.

Let AE be the baſe, EAD the given angle, draw EQM perpendicular to AQ and take $QM = Qm = QA$ and with the aſymptotes A M, A R, and A m, A R, deſcribe two hyperbola's whoſe powers are the rectangles of the ſum and difference reſpectively; alſo deſcribe an equilateral hyperbola whoſe axis is E Q meeting the others in P, p, and draw P D, pd parallel to A R meeting A D in D, d; then A D E, A d E are the triangles required.

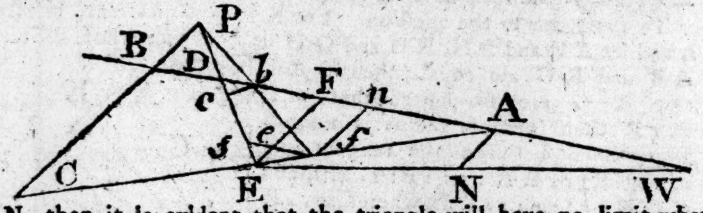
For $DA = DN$ and $DE = DP$ therefore $AD + DE = NP$, and $(AD + DE) \times AD = PN \times AD = ANPR =$ the given power of the hyperbola : Alſo $dE = dp$ and $Ad = dn$, therefore $dE - dA = np$ and



conſequently $(dE - dA) \times dA = np \times dA = nprA =$ the given quantity.

Hence if any point E be aſſumed in AC (ſee Fig. 2.) and EF be parallel to AN and $FM = FE$ and if D be found by this lemma, ſo that $(AD + DE) \times DE = AM \times EW$ then if a line be drawn thro' the point P || to DE a ſimilar triangle will be determined.

To apply this to the problem in queſtion, Let PC be parallel to



AN, then it is evident that the triangle will have no limit when drawn on the ſide of PC fartheſt diſtant from A, but when drawn on the contrary ſide, there may be found ſuch a triangle DEF as will when the queſtion is poſſible be the limit of the triangles drawn on each ſide of it; which limit may be thus inveſtigated.

Let Pf be drawn indefinitely near PE, alſo bc parallel to AC and fes to AB, then becauſe the triangle DEF is at its limit, by the ſuppoſition; the triangle bfn will be ultimately equal to it and their variations alſo equal, that is $Dc + Db + Ee = Fn$. But $DA : DE :: Db : Dc$, and $FA : FE :: Fn : Ee$ therefore $Dc + Db + Ee = \frac{DE}{DA} \times Db + Db + \frac{FE}{FA} \times Fn = Fn$, hence $Db : Fn :: (FA - FE) \times AD : (AD + DE) \times AF$; but $Db : sf :: PD : PE$ and $sf : FE :: DA : AE$, and $fE : Fn :: AE : AF$ conſequently $Db : Fn :: PD \times DA : PE \times AF$; but $PD \times DA : PE \times AF :: (AF - FE) \times AD : (AD + DE) \times AF$, wherefore $PD : PE :: AF - FE : AD + DE$: Let EW be parallel to AD meeting PA in W, and $FM = FE$ then becauſe $PD : PE :: DA : EW$ therefore $DA : EW :: AF - FE : AD + DE$ that is $AD : EW :: AM : AD + DE$. Hence this.

Conſtruction. Draw PDE (by the foregoing lemma) ſo that $AD \times (AD + DE) = AM \times WE$ and EF parallel to AN, then DEF is the triangle required.

N. B. The ſolution of the barter queſtion at p. 20. being founded on Malcolm's falſe principle, which hath generally been uſed by moſt of the modern writers, I drew up, and intended to give a paper on that ſubject in laſt year's Diary, but being obliged to defer it, ſhall here inſert two caſes only, from whence the aforeſaid ſolution may be corrected and anſwers given to problems of a ſimilar kind.

1. Suppoſe A has goods which he ſells at a, but barters at b to have $\frac{m}{n}$ parts of the amount in ready money; B has goods worth c each; what price muſt he rate them at, to be equivalent to A's barter price?

Let x be the price required, then as A receives $\frac{mb}{n}$ in ready money for each piece bartered which is only worth a, the remaining part of each piece which is not paid for but exchanged is only worth $a - \frac{mb}{n}$; but A values it in barter at $b - \frac{mb}{n}$, therefore c muſt have the ſame ratio to x as $a - \frac{mb}{n}$ to $b - \frac{mb}{n}$: Hence this rule.

Subtract $\frac{m}{n}$ parts of A's barter price from his ſelling price, and alſo from his barter price and ſay, as the firſt remainder is to the ſecond, ſo is B's ſelling price to his barter price required.

2. Suppoſe A has goods worth a each which he charges in barter at b; and B has goods worth c each, which he would barter with A, to have $\frac{m}{n}$ parts of the whole in ready money; at what price muſt B rate his pieces to be equivalent to A's barter price?

Let x be the price ſought, then $\frac{mx}{n}$ is the ready money B receives each piece he barters, and therefore the real value of that part of each piece which is not paid for, but exchanged, is $c - \frac{mx}{n}$; but its barter price is $x - \frac{mx}{n}$, wherefore $c - \frac{mx}{n}$ muſt be to $x - \frac{mx}{n}$ as a to b, and conſequently by reduction $a + \frac{m}{n-m} \times b : b + \frac{m}{n-m} \times b :: c : x$ which gives this *rule*.

Add $\frac{m}{n-m}$ parts of A's barter price to his ſelling price, and alſo to his barter price, and ſay; as the firſt ſum to the ſecond, ſo is B's ſelling price, to his barter price.

A correct ſolution to the 12th queſtion will be inſerted next Year.

As to S. Clark's objections in the T. and C. Magazine, they can impoſe upon none but ſuch as are as great dunces as himſelf and therefore deſerve no notice.

ARTICLE XVII.

Additional Remarks on the Equation of Payments.

By Reuben Burrow.

"*THE ingenious and learned profeſſor Hutton, Eſq.*" having in the laſt edition of his Arithmetic, introduced a new and very polite method of confuting the arguments advanced in the Diary for 1777, on the ſubject of equation of payments; *viz.* by repreſenting the writer as a "*malicious defamer and an ignorant pretender*;" and notwithſtanding the authority of ſo conſiderable a perſonage, there being ſtill many people ſo obſtinate as to retain their former opinion, that *abuſe* is not *demonſtration*,

demonſtration, and that falſe reflections on a perſon's moral character ſhould have no place in matters of ſcience; I have therefore in reſpect to ſuch of my readers, taken the liberty, of giving ſome farther confirmations of what I before advanced, and alſo to ſhew, that the rule which the "ingenious profeſſor" affirms to be "*the only* "*true one*," is not only falſe, but even falſe on his own principles; that both Kerſey's principle and Malcolm's when rightly applied bring out exactly the ſame concluſion as the old method which he has reprobated, and that the *learned profeſſor's* miſtakes ariſe from not knowing how to find the amount of a ſum of money for a given time at ſimple intereſt.

As compound intereſt

"Is an increaſe of money day by day
"And month by month, exactly in proportion
"To the elapſe of time"————

ſo ſimple intereſt is univerſally allowed to be that whoſe intereſt is ſuppoſed to bear no intereſt; or which is the ſame, it is a ſum of money payable *at the end of the time* of any tranſaction, for the uſe of money during that time, according to agreement: the truth of this will fully appear from the general practice of the beſt writers, and from common acceptation; for when tranſactions are ſettled according to ſimple intereſt, the ſuppoſition that the intereſt bears no intereſt is the ſame thing as ſuppoſing it to be of no advantage either to the debtor or creditor during the time of the tranſaction; but to have the uſe of money is certainly an advantage, and therefore the intereſt cannot be payable till the end of the time; for if it be payable ſooner, the creditor has doubtleſs a right to uſe it, and of courſe acquires an advantage by it, or which is equivalent, gains intereſt upon intereſt according to ſome ſpecies of compound intereſt; which is contrary to the ſuppoſition; and conſequently either the intereſt is not due till the end of the time, or elſe it is no advantage to have the uſe of money: But perhaps the profeſſor, as being a ſchoolmaſter, may like the argument better in this form:

1. If any thing be payable in the intermediate time, it muſt be intereſt;

2. But the intereſt is allowed to be of no uſe to either party in the intermediate time;

3. Therefore, that which is payable before the end of the time is of no uſe to either party. Now how the profeſſor will contrive to pay the intereſt ſo as to be of no uſe to either party I cannot deviſe, unleſs he do it in the new halfpence that nobody will take;—but falſe principles are not to be eſtabliſhed by a quibble.

Corollary 1. Hence if a ſum of money be put out to intereſt for a given time, the creditor has no right to half the intereſt at the expiration of half the time, but only to ſuch a part as would amount to half the intereſt at the end of the time; and ſo for other intervals, &c.

Corollary 2. Hence alſo, if 1l. be put out to intereſt at the rate r for the time t; its intereſt for any time x leſs than t is $\frac{rx}{1+rt-rx}$: For $1 : r :: t-x : rt-rx$ the intereſt of 1l. from the time x to the expiration of the remainder of the time t, therefore $1+rt-xr$ is the

x payable

amount of 1l. in that time; but rx is the intereſt of 1l. for the time x payable at the end of the time t, wherefore $1+rt-rx:1::rx:\frac{rx}{1+rt-rx}$ the value of the intereſt at the end of the time x: Alſo the amount of 1l. in the time x when put out as above will be $\frac{1+rt}{1+rt-rx}$, which becomes $1+rt$ when x is equal to t.

This being premiſed; let M and N be two ſums of money; the firſt payable directly, and the other at the end of the time t; to find the equated time according to Kerſey's principle.

Let x be the equated time; then becauſe the amount of 1l. in the time t is $1+rt$, the preſent value of N is $\frac{N}{1+rt}$ and therefore $M+\frac{N}{1+rt}$ or $\frac{M+N+Mrt}{1+rt}$ is the ſum of the preſent values, which according to *Kerſey* muſt be equal to the preſent value of $M+N$ payable at x; now by cor. 2. the amount of 1l. in the time x is $\frac{1+rt}{1+rt-rx}$ therefore $(M+N)\times\frac{1+rt-rx}{1+rt}$ is the preſent value of $M+N$ which being made equal to $\frac{M+N+Mrt}{1+rt}$ we have $x=\frac{Nt}{M+N}$ which agrees with the old method.

The ſame data being ſuppoſed, let Malcolm's principle, of the equality of intereſt and diſcount at the equated time, be applied: Then the intereſt of M for the time x being by cor. 2, equal to $\frac{Mrx}{1+rt-rx}$, and the amount of 1l. from the equated time x to the time t being $1+rt-rx$, and the intereſt $rt-rx$, the diſcount of the ſum N at the time x will be $\frac{Nrt-Nrx}{1+rt-rx}$, which being made equal to $\frac{Mrx}{1+rt-rx}$ the intereſt; x is found equal to $\frac{Nt}{M+N}$ the ſame as before, and therefore both Kerſey's and Malcolm's principles rightly applied agree exactly with the old method.

To prove that the profeſſor's concluſion is falſe, on his own principles, nothing more is requiſite than to calculate the intereſt from his equated time to the time of the laſt payment, according to his own method, and it will be found that the creditor will gain more this way, than he could by receiving the payments as they become due, which muſt certainly be a diſadvantage to the debtor, unleſs the profeſſor can demonſtrate that two people may deal together upon equal terms; that one can have no advantage but what he derives from the other, yet one of them ſhall gain and the other ſhall not loſe: As to the uſual pretence that the buſineſs is truly ſettled at Malcolm's equated time, and that the time before or after it, has nothing to do in the matter; if there was any validity in it, the conſequence would be, that it is beſt to judge of things only by halves, and that truth is variable like the ordinate of a curve, and a lie to-day may be true tomorrow, &c. &c. But it is not worth while to beſtow any farther confutation on a method ſo groſsly and palpably falſe, and therefore as the errors remain uncorrected in the two laſt editions of his book (viz. the third and fifth), I ſhall only adviſe the learned profeſſor to correct them in his next *ſeventh* edition.

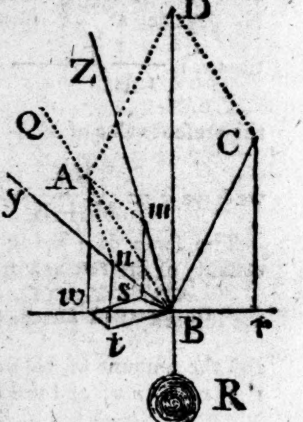
ARTICLE XVIII.

Miſcellaneous Problems and Solutions, &c.

By Reuben Burrow.

PROPOSITION I. THEOREM.

IF R be a weight ſupported in equilibrio by 3 cords, B C, B z, B y, knotted at B; then if a plane be ſuppoſed to paſs thro' R B, B C, meeting the plane paſſing thro' B z, B y in B Q, the force compounded of the forces in the direction of B z, B y, will fall in B Q. For the forces in B z, B y compound a ſingle equivalent force in the plane z B y, and if this force is not in the line B Q it may be reduced to a force in B Q and another perpendicular to it; now either the forces B A and B C in the directions B Q, B C in the plane C B Q keep the body in equilibrio with reſpect to the direction of the plane C B Q, or not; if they do, that is, if they have equal horizontal forces, then the former force perpendicular to the plane C B Q acting at B will draw the body out of the plane and ∴ it will not be in equilibrio; if the forces B A, B C reduced to a horizontal direction are not in equilibrio, one will exceed the other, and this exceſs acting at B in the plane C B Q, together with the former acting at B in a direction ⊥ to this plane, will compound a third force which has no oppoſite force to counterbalance it, and therefore the body will not be in equilibrio, contrary to the ſuppoſition.



PROPOSITION II. PROBLEM.

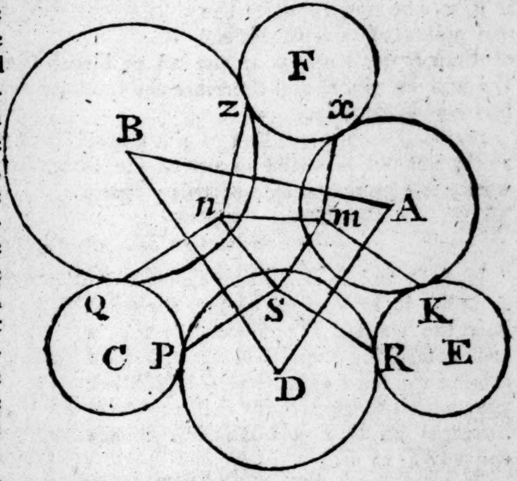
Given the directions of three forces ſupporting a body in equilibrio; required the ratio of the forces.

Let B C, B z, B y, be the directions of the forces and B R the direction of the force ſuſtained; let a plane paſs thro' B R, B C meeting the plane paſſing thro' Bz, By, in BQ; take B D = the force B R in R B produced and in this plane draw D A parallel to B C meeting the interſection of the plane B Q in A; then draw A m ∥ to B y and A n ∥ to B z, then B n, B m, B C expreſs the forces of B y, B z, B P, from whence the practical conſtruction is evident; or the quantities may be found bycalculation for $Bn = \frac{BD \times s.CBr \times \text{coſ.}\,CBr \times s.wBs}{r \times s.\,tBs \times \text{coſ.}\,nBt}$

$BC = BD \times s.CBr$, and $Bm = \frac{BD \times s.CBr \times \text{coſ.}\,CBR \times s.\,wBt}{r \times s.\,tBs \times \text{coſ.}\,mBs}$

Proposition III. Problem.

If three hemiſpheres be placed in a triangular ſituation, with their ſections on a horizontal plane, and a fourth ſphere be ſuſtained by the three; required the preſſure againſt each.

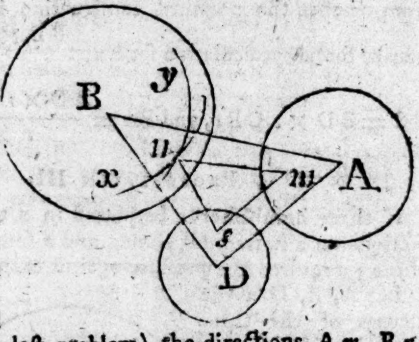


Let A, B, D be the centers of the three given hemiſpheres and E, F, C different poſitions of the fourth ſphere touching the reſt in R, K, *x*, *z*, P, Q; then if the ſphere E be ſuppoſed to revolve round the line D A, touching the two ſpheres A and D, the points of contact will deſcribe two parallel circles whoſe projections R *s*, K *m* will paſs through the points of contact R and K, and be projected into right lines on the horizontal plane; by the ſame reaſon when the ſphere revolves about D B and B A the circles deſcribed by the points of contact will be projected into right lines, and conſequently the interſections of thoſe right lines give the projections of the points of contact (made by the ſphere when ſuſtained at reſt) upon the plane of the horizon; wherefore the point *m*, *n*, *s* thus found are given, and alſo the lines A *m*, D *s*, B *n*; now if *n*, *m*, *s* be ſuppoſed to repreſent the points of contact made by the third ſphere when ſuſtained by the reſt, all the forces ſuſtaining it paſs through it's center in the directions A *m*, B *n*, D *s*; wherefore, the directions of the forces being given, the forces themſelves may be found, by the laſt problem.

Proposition IV. Problem.

Three ſpheres being placed on a horizontal plane ſuſtaining a fourth; required the force ſuſtained by each.

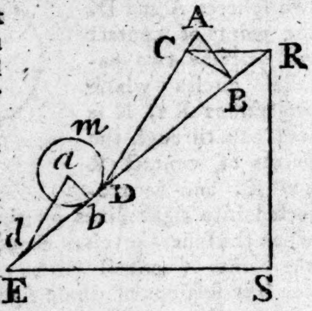
Let A, B, D, be the given ſpheres on the plane of the horizon, then if the fourth ſphere be ſuppoſed to touch the ſpheres B and D and to revolve round the line B D, the projection on the plane of the horizon of the circle deſcribed by the point touching the ſphere B will be an ellipſe whoſe axes and poſition are determinable from the data;



data; in the ſame manner the ellipſe deſcribed in conſequence of the revolution of the given ſphere about A B is determinable, and therefore the point of their interſection *n* may be found, and by the ſame method may the other two projections *m* and *s* of the points of contact on the plane of the horizon, be determined: Then if *n*, *m*, *s* be now ſuppoſed the real points of contact inſtead of their projections (as in the laſt problem) the directions A *m*, B *n*, D *s* will be given, and therefore the preſſure againſt each ſphere may be found by prop. 7.

N. B. The 329 queſtion of the Ladies Diary which was propoſed in 1750, but not anſwered in any of the ſucceeding publications of that work, is a particular caſe of this problem.

PROPOSITION V. PROBLEM.



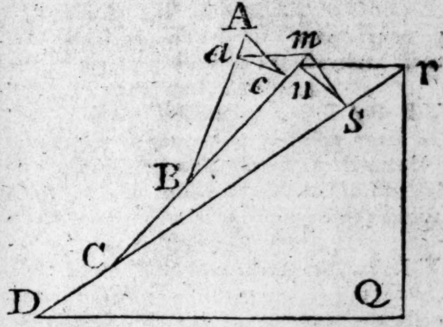
If A D and D E are two planes inclined to each other in an angle A D E; it is required to find the point R in the plane E D produced, ſo that a body deſcending from R along R E ſhall acquire the ſame velocity at E as another body which deſcends from A down A D, impinges on D E and deſcends thence down D E to E.

Draw A B perpendicular to E D meeting it in B, draw B C ⊥ to A D meeting it in C, and draw C R parallel to the horizontal line E F meeting E D in R; then R is the point required.

For let *a m b* be the poſition of the deſcending body (which is here ſuppoſed a globe) at the inſtant it impinges on the plane D E, and draw *a d* parallel to A D and *a b* perpendicular to D E; then becauſe any force *a d* may be reſolved into the forces *a b* and *b d*, it is evident that if *a d* repreſent the velocity acquired by deſcending through A D, the inſtant before it impinges on D E, then *b d* will repreſent the velocity with which the body proceeds along the plane D E the inſtant after the impingement, and theſe velocities are as *a d* to *d b* or A D to D B by ſimilar triangles; but A D is to D B as $\sqrt{AD}$ to $\sqrt{CD}$ and this laſt ratio is as the velocity acquired by falling through A D to the velocity acquired by falling through C D, or R D, and therefore the velocity acquired by deſcending through R D is the ſame as the body has, after deſcending through A D and impinging on D E; wherefore as their velocities are the ſame, at D, they will alſo be ſo at E, and conſequently the velocity acquired by deſcending from A to E will be the ſame as by deſcending from R to E or from R to S.

PROPOSITION

Proposition VI. Problem.



If AB, BC, CD, &c. be any number of planes given in poſition, it is required to find the velocity that a body acquires by deſcending thro' them all.

Draw An perpendicular on CB produced, and $n a$ $\perp$ to AB, and $a m$ parallel to the horizon, meeting CB in m; then draw $m s$ perpendicular to DC produced, and $s c$ $\perp$ to CB, and $c r$ parallel to DQ, meeting DC in r; then rQ is the height through which a body deſcending will acquire a velocity equal to that acquired by the body in falling through all the planes.

For the velocity acquired in deſcending from A to C is equal to that acquired by deſcending from m to c by the laſt; and by the ſame reaſon, the velocity acquired in falling from m to D is equal to that gained by falling from r to D, or from r to Q, &c.; wherefore the velocity acquired in falling through rQ is equal to that acquired in falling from A to D.

Scholium. This propoſition hath been generally uſed by writers of mechanics, to prove that a body acquires the ſame velocity in deſcending through a curve as by falling through its perpendicular height; that this concluſion is true, appears by conceiving the above figure to become a curve, for the angles ABn, &c. being then indefinitely ſmall, the points A, a n, m, &c. coincide, and rQ becomes the curve's altitude; but thoſe writers deduce it from two abſurd ſuppoſitions. *Maclaurin* and *James Gregory*, are, I believe, the only authors that have noticed the miſtake; the firſt in p. 211 of his account of *Newton*'s diſcoveries, and the latter in a ſmall treatiſe, publiſhed at *Glaſgow* in 1672, under the name of *Patrick Mathers*, entitled, "*The Great and New Art of Weighing Vanity.*"

New Mathematical Questions *to be anſwered in next Year's* Diary.

[41] I. Question, *by Mr.* George Sanderſon.

If a given chord biſect the diameter of a given circle in D; to draw a line from one end of the diameter meeting the circle in F and the chord in E ſo that the ratio of DE to EF may be given.

[42] II. Question, *by Mr.* T. Barker.

If two given circles be ſo placed that a given point P divides both their diameters in the ſame ratio, and S be alſo another given point; it is required to draw PAB cutting the two circles in A and B ſo that the angle ASB may be the greateſt poſſible.

[43] III. QUESTION, *by Mr.* John Hampſhire.

PP is a given circle and C A, C B, are lines, given in poſition; it is required to find the points in the circumference from whence perpendiculars being let fall on C A, C B ſhall make the diſtance of their interſections a given quantity or the leaſt or greateſt poſſible.

[44] IV. QUESTION, *by Mr.* J. Jackſon.

IF P A B be a given triangle, and B M be drawn meeting P A in the given point M; it is required geometrically to draw P S H meeting B M in S, ſo that S T being drawn parallel to P A meeting B A in T, and T H being drawn parallel to P B meeting P S in H the perimeter of the triangle S T H may be either a given quantity or a *minimum.*

[45] V. QUESTION, *by Mr.* John Burrow.

IN any polygonal figure of an odd number of ſides, if each two ſides containing an angle be produced to meet the ſide oppoſite that angle; or if the number of ſides be even, and each two ſides containing an angle, be produced to meet the two ſides containing the oppoſite angle; then will the ſum of all the ſaliant angles of the figure thus generated be equal to two right angles, if the number of ſides be odd, but equal to four right angles if the number of ſides of the polygon be even.

[46] VI. QUESTION, *by Mr.* Joſeph Edwards.

SUPPOSE a ſtick three feet long with one end reſting on the palm of the hand, and inclined to the horizon in an angle of 60°; required the time of travelling 100 yards, ſo that the ſtick may preſerve the ſame inclination to the plane.

[47] VII. QUESTION, *by Mr.* Reuben Burrow.

HAVING given two points through which a great circle is to paſs; it is required to find the pole of that great circle geometrically, and alſo to cut off a given arch from it; according to the orthographic projection of the ſphere.

[48] VIII. QUESTION, *by Mr.* Thomas Todd.

REQUIRED the curve into which a hollow cylindrical tube muſt be bent, ſo that being revolved about an axis at right angles to the horizon with a given velocity, a globe put in any part of the tube may remain there without aſcending or deſcending.

[49] IX. QUESTION, *by the Rev. Mr.* Crakelt.

FROM a given point it is required to draw a right line cutting two circles given in magnitude and poſition ſo that the parts of the line intercepted by theſe circles may have a given ratio. *N. B. The 28 Prob.* 233 *of Simpſon's Geometry is a particular caſe of this; but the general problem admits of a ſimpler conſtruction than that there given.*

[50] X. QUESTION, *by Mr.* Thomas Moſs.

TO divide a given angle into two ſuch parts that the rectangle contained under the difference of their ſines, and the ſum of their coſines anſwering to two given unequal radii, may be of a given magnitude.

[51] XI. PRIZE QUESTION, *by Mr.* Jeremiah Ainſworth.

A Perſon undertakes to throw with a pair of common dice, the chance Seven before any other ſhall come up twice; required the *exact* probability of doing it?"

N. B. A ſolution to this Problem hath before been attempted but 'tis apprehended without ſucceſs.

Whoever gives the beſt ſolution to this queſtion before the firſt of May ſhall receive a Prize of Twelve Diaries, and the next beſt a prize of Six Diaries.